THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S).

1909 EDITION

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THE NEW PATENTS ACT.

THE latest decision under the Manufacturing Clause of the Patents Act of 1907 is of especial interest, since it relates to an electrical patent and covers some novel points in relation to licences.

The application was that of George Braulik for the revocation of Letters Patent No. 18,786 of 1902, of which the British Westinghouse Electric and Manufacturing Co. are the registered proprietors, on the ground that the patented article was manufactured exclusively, or mainly, outside the United Kingdom.

Mr. Scanes, the secretary of the British Westinghouse Co., in the first declaration filed in the case, disputed the allegation, and stated that in the years 1905 to 1908 1,308 lamps had been manufactured at Trafford Park, of which 274 remained unsold on October 23rd, 1908.

He maintained that inasmuch as the company had manufactured as many lamps as it could sell, the patented article was manufactured to an adequate extent in the United Kingdom; and he complained that the sales of the lamp were materially interfered with by the *unauthorised importation* of infringing lamps. He also mentioned that an action to restrain such unauthorised importation was pending against the applicant; and ended by declaring that if the patent were revoked, the applicant would be able to import lamps manufactured in accordance with the patent with impunity, and that in such case it would be impossible to carry on the manufacture of lamps under the patent in the United Kingdom at a profit.

It appears from the evidence subsequently furnished that the Westinghouse Co. on March 12th, 1906, granted a licence for a period of five years to Messrs. Koerting and Mathiesen, a German company, who are represented by the Union Electric Co. in this country. Under this licence the Westinghouse Co. receive a substantial royalty in respect of every lamp made and imported here. During the years 1906 to 1908 9,856 lamps were so imported.

The comparison of the number of imported lamps with those of home manufacture led the Comptroller-General to ask Mr. Scanes how he came to state in his declaration that the statement of the applicant was incorrect. He replied that he was advised to make that statement, and his counsel supported him. It may be assumed, therefore, that the accuracy or inaccuracy of the contention is a matter of legal interpretation upon which, in the present state of the case, it is not permissible for us to comment, but the Comptroller also records in his decision the statement of the applicant's counsel that the information regarding the licensed importation would never have been forthcoming for this case, but for the fact that the applicant for revocation happened to possess it. According to the interpretation placed by the Comptroller-General upon the arguments of the patentees' counsel, he (counsel) relied in support of the statement that the patented article is not manufactured mainly abroad, on the fact that the patent has been infringed, and that many of the infringing lamps have been made in this country, upon which the Comptroller-General remarks :—

But it is to be observed that the infringements of which complaint was made in Mr. Scanes' declaration consisted of the *importation* of infringing lamps; and not the *manufacture* in this country of infringing lamps. It is true that it appears from the evidence given at the hearing on behalf of the Westinghouse Company by Mr. Eck, the secretary of the Union Electric Company, Ltd., who act as agents for the German Company, that it is alleged that his company were aware of several infringing firms making and selling large quantities of these lamps in this country, and that it is alleged in one town alone 200 lamps were so manufactured and sold. But no suggestion has been made in this case that the majority of the infringing lamps are manufactured in this country; and unless an overwhelming majority of them are manufactured here, the patented article must be mainly manufactured abroad, even if the number of lamps manufactured abroad in accordance with the patent and not imported into the United Kingdom is not taken into account. I do not therefore understand how the statement in Mr. Scanes' declaration that the allegations of the applicant in his application were incorrect can be justified.

The Comptroller-General was satisfied on the evidence that the allegation that the patented article is manufactured mainly outside the United Kingdom is correct, and proceeds to consider :—

Whether the patentees have proved that it is manufactured to an adequate extent in the United Kingdom, and if not whether they have given satisfactory reasons why it is not so manufactured.

It was contended for the patentee that the manufacture at Trafford Park is clearly an adequate manufacture, because the company manufacture more than they can sell, but the Comptroller-General had to consider also the importation under licence. He said :—

The expression "patentee" is defined by Sec. 93 of the Act as meaning the person for the time being entitled to the benefit of a patent. I have some doubt whether or not in the present case the German Company, who are undoubtedly interested in the present application for revocation, are included in this definition: but it was obviously desirable that they should have an opportunity of being heard with respect to it. They were represented at the hearing by the same patent agent and counsel who appeared on behalf of the Westinghouse Company.

Thus, in giving consideration to the question of manufacture, coupled with importation, the Comptroller-General states the argument of the patentee's counsel to be practically that if the patentee :—

grants, as has been done in this case, a licence to a licensee, who does not manufacture the patented article in this country, but imports it in very large quantities, he himself manufactures the patented article to an adequate extent in this country, however small his manufacture here may be, provided that it is not smaller than the margin between the demand for the article and the number of the articles imported.

On such an argument the Comptroller-General remarks that :—

It is obvious that, if any such interpretation is to be placed on the words "adequate extent," the section will be inoperative in any case in which a foreign manufacturer can persuade the proprietor of a patent that it will pay him better to take a royalty on every lamp imported, whilst he himself manufactures here on an infinitesimal scale, than to manufacture the patented article himself in this country to any substantial extent.

After considering an argument raised under the International Convention of 1883, which, he thought, had no bearing on the case, he states :—

The interpretation which I place on the words "to an adequate extent" is, to such an extent as will substantially satisfy the demand in this country, even if no importation takes place.

Having disposed of the contention that the manufacture is not adequate, the Comptroller-General says :—

It remains to be considered whether the patentees have given satisfactory reasons why the patented article is not manufactured in this country to an adequate extent. So far as I am able to understand the arguments of their Counsel the main reason which the Westinghouse Company have given for their failure to manufacture the patented article to a greater extent than they have done in the United Kingdom is that they have been so unfortunate as to grant a licence to the German Company which cannot be determined before the expiration of 5 years from the date of the licence, *i.e.*, until the 1st January, 1911, the consequence of the granting of which has been to render it impossible for them to sell more of their lamps than the public are willing to buy having regard to the large importations of good lamps by the licensees, the bad reputation which the Westinghouse lamps had some years ago, and the alleged unlicensed importation and manufacture by infringers. He urges that the unfortunate patentees have no control over the licensees; that they cannot prevent the licensees from importing as many of their excellent lamps as they please; that the Westinghouse Company are now, owing to their improvements, becoming serious competitors with the German Company and are making a few more lamps than they can sell. In other words, as I understand their arguments, the existence of this unfortunate licence, which was granted before the Act of 1907 was passed, is given as a satisfactory reason why the patented article is not manufactured in the United Kingdom to a greater extent than the Westinghouse Company have yet manufactured it, and as a conclusive reason why the patent should not be revoked.

Here again, although the burden of proof is thrown on the patentees, I am at once confronted with another difficulty, owing to the withholding by them of evidence as to facts of which they must have full knowledge, but which they are unwilling to disclose. They object to the production of the document in its entirety. I and the Counsel for the applicant have been allowed to see parts of it; and in the course of the hearing evidence has been given as to certain other parts of it, which we have not seen. The Counsel for the applicant pressed very strongly to be allowed to see the whole document, but this was objected to by the Counsel for the patentees. In these circumstances, it is, of course, impossible for me to hold that the existence of a document which I have not been allowed to see, and of some of the contents of which I have no knowledge, is a satisfactory reason why the patented article is not manufactured in the United Kingdom to a greater extent than it has been.

The existence of such a licence as this one, so far as could be judged from the parts disclosed, could not, he considered, be regarded as a satisfactory reason why the patented article is not manufactured to an adequate extent in this country.

Even if it disclosed satisfactory reasons why the Westinghouse Co. are unable to manufacture more lamps than they do it would not, so far the Comptroller-General can see, explain why the German company do not manufacture their lamps in the United Kingdom.

This Company, Mr. Eck says, are the premier firm of arc lamp manufacturers in the world. He admits that they have no present intention of manufacturing the patented article in this country; but no evidence is forthcoming to explain satisfactorily why they have not already done so. They seem to me, as at present advised, to have a greater interest in the maintenance of the patent than the Westinghouse Company. It is admitted that they pay to the Westinghouse Company substantial royalties, the amount of which their Counsel strongly objects to disclose, for every lamp which they import, and these royalties they will, their witness tells me, have to continue to pay, even if the patent is revoked.

On the facts, so far as they have been disclosed, it certainly seems to me that they would be greater losers than the Westinghouse Company if the patent were revoked.

In conclusion, the Comptroller-General says :—

On the evidence before me, I have come to the conclusion that the patented article has not been manufactured to an adequate extent in the United Kingdom, and that the reasons given by the patentees why it has not been so manufactured are very far from satisfactory.

I therefore decide, subject to an appeal to the Court, to revoke the patent forthwith, and I order the patentees to pay to the applicant the sum of seventy-five guineas in respect of his costs.

The reversion which the Act of 1907 has produced in the rights of an inventor, are well illustrated in such a case where an importer of lamps alleged to be an infringement of a patent, and paying no royalty, obtains a revocation of the patent by reason of the importation of lamps upon which a royalty is paid. It further illustrates the hardship to an

inventor, to which we made allusion recently, of applying conditions which did not exist when the invention was disclosed. The hardship in this case is intensified by the fact that the patentees were under the obligations of an agreement also entered into before the passing of the Act. It further illustrates the illusory nature of the protective feature, since the importation which existed before may be expected to be increased rather than diminished. In thus commenting we refer, of course, to the Act and not to the decision. The Comptroller-General has to administer the Act, and not to consider its merits or demerits.

Boiler Inspection.

We have heard it said that no lawyer ought to have a seat in Parliament, for lawyer-made laws are so hopelessly unintelligible that they cannot be administered except expensive litigation be carried on—for the lawyer's benefit, of course—in order to define every term that has been employed.

Take, for example, the Factory and Workshop Act, on which comment is made in connection with the inspection of boilers in the last report of the Manchester Steam Users' Association. The law places on a boiler owner the onus of having his boilers examined by a "competent person," Parliament itself having substituted this expression for that of "competent engineer." Thus, it is open to any person to make a boiler inspection, and to give a certificate of safety, even if he be wholly unacquainted with boilers, and where an inspection is made by a boiler insurance company, the certificate must be signed, not only by the chief engineer of the company, but by the competent person.

Boilers are liable to many and various defects, more or less serious, and where there is corrosion, a correct judgment can only be arrived at by a man who has had very special experience. For general boiler inspection work, we are of opinion that even a well-trained engineer requires to pass through a further period of experience before his judgment can be fully relied upon.

A case is cited where a steam user employed a person to examine a boiler—which afterwards exploded—who was so untaught that his hand had to be guided when signing the certificate; yet such were the doubts as to the meaning of "a competent person" that no steps were taken to punish the steam user for selecting such a person. When as a result of lawyer-made law an accident happens there is an investigation—again chiefly by lawyers—and very pitiable exhibitions some of these Board of Trade inquiries are. The legal men at once place themselves in the attitude of prosecuting or defending counsel, badgering willing witnesses, confusing issues, and making a woeful display of their own absolute unacquaintance with the subject they are working upon.

We should be sorry to see boiler inspection placed under State control, for manufacturers are already sufficiently harassed, and a State inspection would be worked in an intolerable manner. But the legislation of the last 20 years appears to us to have been devised solely with a view of creating such an *impasse* as to give an excuse for interference. In no country are boilers safer than in this.

All steam users should support the boiler insurance companies by insuring their boilers, and, instead of their doing all they can to thwart them, they should follow the advice that is given them, and insist upon having their boilers thoroughly inspected at least once a year.

Without inspection boiler insurance is a farce. It would, of course, be easy to insure boilers and make no inspection, and it might be very profitable by the law of averages, since only one boiler in some thousands explodes badly. But genuine insurance implies inspection and safety, and though there may be faults, we believe the greatest safety lies in inspection by the regular associations, and not by casual inspectors, unless these have had the special training acquired in regular inspection work.

The New York City Railway.

Having descended into the pit, *i.e.*, into the hands of official receivers, the New York City Railway is working out its own salvation, and may be expected to become rehabilitated shortly if its progress in the future is as promising as it has been during the 18 months' sick nursing.

American journals are jealous of the good name of their country and of everything therein, so that it has been left to visitors to tell us how very badly maintained are many of the large tramway properties, and for the sake of confirmation of what otherwise might be called travellers' tales, we are glad to read the official reports which chronicle disaster or the process of recuperation. Such experiences put us also on better terms with ourselves, who are more ready nationally to foul our own nest than the Americans, and with a morbid eagerness point out faults which, in some other countries, would rank almost as virtues.

When the receivers took over the New York City Railway, the general equipment, with the exception of the power houses, had been allowed to deteriorate until a collapse was imminent, and the condition of the car-sheds with respect to fire risk is well shown from the fact that 680 cars were consumed in four fires before or during the receivership. This alarming state of affairs seems to have been due largely to the use of old horse car-barns for electric cars without the adoption of precautions which the introduction of electric current required.

The car-houses have been rebuilt with due regard for fire hazard, and throughout the undertaking the most elaborate precautions are taken to prevent the outbreak of fire either through accident or malice. All new car houses are constructed of steel reinforced with concrete, with additional fire walls, in order to reduce the area subject to conflagration, and sprinklers are installed.

It has occurred to us frequently when looking at some of our largest car depôts, that the fire insurance companies have neglected their own interests by permitting the construction of such very large open areas under a single roof, and that the tramway proprietors are unwise to allow such risks to remain. On the other hand, fires in our depôts are almost unknown, probably because they are constructed substantially and watched carefully, so that we have small cause for croaking.

One of the means to salvation adopted by the New York City Railway is the P-A-Y-E car, of which about 300 are in use or on order, and the receivers say that the results with these cars have demonstrated indisputably that they afford more comfortable and satisfactory accommodation than any other car used previously in New York.

When a tramway falls on evil days, not only its *matériel* but its *personnel* goes to pieces, and this is demonstrated aptly by the following table, which indicates the reduction of accidents of all kinds during the 12 months of the Receivers' sway :—

Personal accidents, decreased	...	9·4	per cent.
Wagon collisions "	...	19·1	"
Car " "	...	46·1	"
All accidents "	...	13·8	"

The conduit, like everything else, had been allowed to fall into disrepair, but much has been done to remedy the defects, and the cars now run "with less noise and jar, materially adding to the comfort of the passengers" and of residents along the route. What a clatter there must have been before!

Imagine, ye who are immersed in statistics which yield the cost per unit and per car-mile of everything, down to the milk drunk by the depôt cat, imagine the state of a huge business like the New York City tramways, in which it was incumbent on the receivers "to institute a method of detailed systematic accounting by the assignment of given job numbers to the different classes of work." What wonder that the receivers' services were necessary!

The rehabilitation of the company has involved the surrender of leases of subsidiary lines to the value of £2,000,000 per annum, and the consequent withdrawal of transfer privileges which those lines held mutually with the City Railway.

AN ELECTRICALLY-DRIVEN 2,000-H.P. ROLLING MILL.

[BY OUR BERLIN CORRESPONDENT.]

The Röhling Iron and Steel Works at Völklingen, Germany, contain a 2,000-H.P. rolling mill for the manufacture of wire and iron bars. This is made up of a roughing-down train, consisting of three frames of 450 mm. roll diameter, and a finishing train, consisting of 11 frames arranged in three groups.

The roll diameter in the first group of the finishing train is 350 mm., in the second group 250 mm., and in the third one 250 mm.

A 2,000-H.P. gas engine (100 R.P.M.) and a 2,000-H.P. high pressure three-phase motor (5,000 volts, 100 R.P.M., 50 cycles), supplied by the Felten and Guilleaume-Lahmeyerwerke, serve to operate this rolling mill.

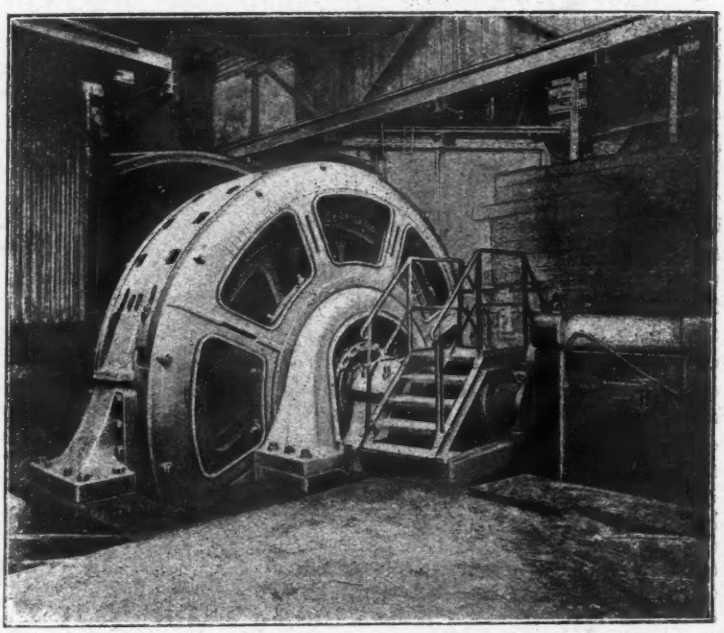
The electric motor, which owing to its great elasticity and overload capacity, in the case of the very exacting service of a rolling mill, is far superior to the gas engine, is designed for standing a temporary overload of 100 per cent. and for dealing with the service by itself, without any help from the gas engine. It is connected up between the roughing-down train and the rope pulley coupled to the gas engine, so that all that is required for throwing the whole of the load on to the electric motor, is to uncouple the gas engine.

The diameter of the rope pulley is 7 metres, the weight of the rim 70 tons, and the total weight 100 tons.

The rope pulley, which at the same time acts as fly-wheel, has a speed of 100 R.P.M., and drives the first group of the finishing train through five ropes of 50 mm. diameter at 250 R.P.M., and the second and third groups through 12 and 15 ropes at 400 and 500 R.P.M. respectively.

The finishing train is used for rolling roughed-down ingots of 100 to 150 mm. cross-section and about 130 kg. weight, to wire of 4·9 to 8 mm. diameter or band iron 18 to 30 mm. in width.

In designing and erecting the electric motor, care was taken to ensure an arrangement as compact as possible (on account of the relatively small space available in an axial direction), a very substantial construction capable of dealing with the frequently occurring sudden shocks, ease of repair and to provide for special means of turning the starter round. The motor is started by means of a liquid starter.



2,000-H.P. Rolling Mill Motor at a German Iron and Steel Works.

Employers and House of Lords.—At a meeting of the Employers' Parliamentary Council, held at Westminster last week, a resolution was adopted in support of the following motion which the Earl of Wemyss will bring forward in the House of Lords in the forthcoming session:—

"1. That in the opinion of this House it would be for the public good that important national trading and other organisations and societies would each name three Peers in the current and each succeeding Parliament to speak and act on behalf of such societies in all questions in which they are interested, and that the names of the Peers so nominated be entered in the Journals of the House.

"2. That the Lord Chancellor, the Marquis of Lansdowne, the Earl of Crewe and the Earl of Halsbury be empowered to determine what societies are of sufficient importance to be admitted to the said privilege of nomination.

"3. That no Peer shall be entitled to vote on any public question who has not attended 20 sittings in the current or previous session of the House."

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity in Mines.

Referring to Mr. Sydney F. Walker's letter that appeared in the Electrical Review a short time ago, he has left very little to be said in reference to the use of electricity in mines. My idea about this matter is that safety is the first consideration, and where there is likely to be any gas, electricity should not be used; take electricity as far as you can with safety, and then use compressed air. An electrically-driven air compressor is my idea of an ideal system for mine work; you get the efficiency of the electricity combined with compressed air, also the added safety of the latter. You can make permanent motors, switch boxes, &c., gas-tight, but if a fall of roof should cut the cable in two, or drag it out of the insulated bushing of the switch box or motor, during the time the motor is running, the result is bound to be a heavy flash. Now, suppose there should be any gas in this place in the return airway, where is safety? My idea is that motors should not be used in the return air-way, unless they are placed in proper engine rooms, with bricked walls and steel girders to support the roof. This lessens the danger of falling material doing any damage to either cables, switch boxes, bushings, or coverings of any description. But I say, ventilate all motor rooms with intake air if possible. The greatest danger arises from the use of portable electrical machinery. If there is likely to be any danger through the presence of gas on any coal face, and the seam is known to be liable to outbreaks of gas, portable electrical machinery is dangerous, owing to the following reasons: Trailing cables getting cut in two during working hours; cables being dragged out of place through falling material; switch boxes, &c., not being properly secured. With reference to the competency of the electrician in charge, he ought to be a man who thoroughly understands his work, and a manager should be quick to find that out; but if the electrician in charge has as many medals as Colman's mustard, that won't prevent accidents due to the ignorance of the drivers, &c., who attend to and run the machines underground. Mr. Walker hit the nail on the head when he said the miners, &c., ought to have an elementary knowledge of electricity. Another writer said a little knowledge is dangerous; but I say having no knowledge

is worse than dangerous. We have done our best to educate our miners, &c., for some years to the dangers arising from the use of electricity, and what to do and when to do it, with reference to cables and accidents of any description. I may say that our plan has proved a great success. It does not matter how clever the electrician-in-charge may be, he cannot shift the responsibility off the manager. This is as it ought to be. The electrician can only advise the manager to the best of his ability, and do his work in the same way, and there the matter ends; it rests with the manager to know and to find out if his electrician is a capable man, and if not he has an easy remedy, or he himself must suffer. The electrician cannot hinder the manager taking electricity where he thinks fit, or using any kind of electrical appliance or doing what he likes with his own mine. Therefore the manager is the proper person to have the responsibility; but every person should be competent for the work he is set to do, and if machine men, &c., knew more about their work and cheapness was not the greatest consideration in many cases, perhaps accidents would be much fewer. But I still maintain that if gas appears, let electricity disappear; because with all the modern improvements it is an utter impossibility to guard against sparking and flashes, due to the conditions of the mine. What I mean to say is—faulty roof, runaways of corves, carelessness, ignorance of persons employed to attend to machines, and sometimes laziness. I have seen when we have had to fine some drivers 5s. for being asleep beside their motors. It must have been the hum of the motor that soothed them so. In reference to the Government inspector's remarks *re* sketchy ideas, I may say that he spoke the truth. I have had to refuse motors, switch boxes, &c., on behalf of the manager, that were not gas-tight, nor even flame-tight, that were sent out of the works to us as gas-tight, but the material was of the best, and I say that this was due to not knowing the underground requirements of a mine. Of course, there are mining engineers employed by some firms, but the question is, are they good all-round practical colliery electricians? It is no use trying to shift the responsibility from one person to another; if machinery upon arrival is not up to standard requirements for the particular mine it is ordered for, send it back. See that every man does his duty. Every man is only a part of a huge machine that governs the mine, and keeps it going, and one man cannot do all the work himself, nor be expected to do so. I say, let every person do his atom, all work to system with skill, and all work together with right goodwill, with one end only in view, that is *safety*.

Mines Electrical Engineer.

An Overcrowded Profession—Where to find Employment.

I have read the above note on page 260 of your last issue, but if one turns to your "Advertisement" columns he will see, every week, far worse examples than this one which you think worthy of special mention. For instance:—

Switchboard attendant wanted for high-tension power house and sub-station. Wages 10s. per week of even 8-hour shifts, increasing, if satisfactory, in three months to 12s. 6d., and in six months later to 15s. State age and particulars of training.

Please note that this is an advertisement for a man fully qualified to handle high-tension switchgear, &c. He has to state "particulars of training." Probably a man who has spent £600 to £700 in Faraday House or some other training college will apply for this magnificent job, where he will be paid at nearly (not quite) the rate of 2½d. per hour. Think of it again, 2½d. per hour!!! Your office boy or your old night watchman would scorn to accept such terms, even though he starved for the want of it. The person or persons who are responsible for the above advertisement have need to take shelter under a friendly box number. Next week I daresay we shall see under "Appointments Filled":—

Box 2,211. Applicants are thanked and informed that this vacancy is now filled.

Surely it is better to go into the workhouse and be able to earn not only warm lodgings and clothes, but extra (or officers') rations, than stay out of the workhouse, and earn 2½d. per hour doing skilled work, is it not? I cannot bring myself to think that it is a chief central station engineer who is responsible for the fixing of the remuneration in this case. If it is, I hope his committee grind him down in like manner, for if his switchboard attendant (they might reasonably argue) is only worth 2½d. per hour, he is certainly not worth more than 8d. an hour.

For some weeks we have seen another unspeakably mean advertisement of some despicable person or persons who want a—

Young gentleman with previous experience, to train as chief assistant in a lighting station. Premium, 30 guineas. Wages, 10s. after 12 months.

You will see that we will now have to pay premiums for posts, and in addition have "previous experience." The unfortunate who is fool enough to part with his 30 guineas is to be "trained as chief assistant." What does this mean? Any station pupil hopes that he is being trained for chief, in some cases his ambition will be realised, in some cases it will not. It nowadays depends upon, with exceptions few and far between—

1. The amount of money he has at his back.
2. The influence that can be brought to bear in his favour.

Chief engineers of stations who try and get skilled men for 10s. a week, or insist upon these men paying a premium, are only, after all, cutting their own throats, and if this kind of thing is allowed to go on, many of them will find themselves in the gutter, and be able to sympathise with the assistants which they formerly ground down. What is 0·1d. per unit sold added to the salaries of their staff in comparison with the honour and credit of their profession? Yet this 0·1d. would, in many stations, treble the salaries of all the underpaid staff, and more also. In addition to this, it would provide the chief with more standing and respect, and by the extra encouragement given to his ground-down staff, he would probably find that they would save him far more than the 0·1d. in other directions. Our workmen have their unions and societies, which, at all events, do their best to protect them against the sweating system, and have been fairly successful in this. We have our Institution of Electrical Engineers, and we can put M.I.E.E. or A.M.I.E.E. after our names, and pay two to three guineas a year, yet this does not save us from our 2½d. per hour.

After spending some £750 on my own training in a technical college and shops, I started at 15s. a week as "junior assistant engineer" in a large high-tension single-phase station, and I worked 60 hours a week, and was responsible for a shift. With no influence behind me, and no money, I find myself after 14 years' hard struggle chief of a little station at a salary of £170 per annum. I am steady, do not drink, tall, fair appearance and athletic. My father was a vicar of the Church of England. I got many prizes at a large public school, and was third (average) in the final examinations of one of the principal London technical colleges. I have excellent testimonials from every position I have held, and at the age of 32 I feel myself a failure. A pupil working under me 10 years ago is now chief of a fine large station, and he has never had any training except three years in the central station where I was shift engineer at the time. I was on the short list with him.

Ohm Sick.

February 15th, 1909.

Featherstone Colliery Explosion.

It is certainly a pity that Mr. Pickering should have given expression to his opinion in the manner he did. Doubtless his report is calculated to do harm to the use of electricity in mines. The phrasing of that sentence relating to "sketchy ideas" has an interpretation obviously disquieting, inasmuch as whatever substitutional power is employed by colliery owners and managers, electrical gear should be regarded as too dangerous.

I cannot employ the term "useless," for the reason that the few experts (they are few) know that if colliery owners and managers generally would very often only listen to reason and (not as they nine times out of ten do) adopt the hazy opinions of those who have little knowledge of the requirements and conditions, trouble of this description would not occur.

E

It is certainly at all times very necessary that switchgear requiring mechanical operation should be oil immersed, but very often the initial cost is a consideration to the owners, who usually are guided by the advice furnished by the colliery electrician.

But did the trouble really originate in the box containing the switchgear? Even if the circuit were broken, it would take an abnormally long arc to cause the explosion unless that part of the workings where the box was fixed was heavily surcharged with gas (not foul air). Even with an abnormal accumulation of gas, the mere breaking of a switch connected to which were cables of a very low resistance with a consequent low induction would hardly have had the effect suggested by Mr. Pickering. On the other hand, such damage could and would take place were some part of the generating plant or motive power generally connected in such a way that when the switch referred to was broken the E.M.F. of self-induction might be very high, and so account for the trouble.

I know of several collieries of which I have had experience in Northumberland and the West of Scotland which until quite recently had open-type machines operating in inflammable mines; even now the majority of colliery owners and managers are throwing out the old-fashioned compressed air receivers and adopting the use of electricity, particularly alternating, which has advantages over direct current that they decidedly appreciate.

James Graham.

February 15th, 1909.

Tired Arc Lamps.

I would suggest that "E.W.B." goes over his arc circuits in the following order:—

1. Examine all switches, fuses and connections, even the carbon holders, for heating or arcing.

2. Examine brakes or clutches, as the case may be, see that they are adjusted to take the carbons the proper distance apart; also examine dashpots, levers, cores and their bearings and rubbing surfaces, make sure that they are free from friction.

3. Where the series coil is encased in an iron body, test the outer layer of the series coil for a short to the body. Some lamps have German silver wire on the outer layers of their shunt winding, which becomes brittle and breaks off, causing the others on the same series, of course, to have a very tired appearance.

4. In some types of resistance coils, flexible copper wire is used for short-circuiting part of the coil, and this may be making bad contact or even burnt clear.

5. If auto-cut-outs and substitutional coils are used, the cut-outs may be partially shorted or making intermittent contact.

D. B.

Malta.

In view of the fact that a large number of people come out here to serve under Government, I wish to warn those that, in making Malta their place of residence, they must be prepared to be in such good health that they can withstand the vampire-like actions of the inhabitants, and I regret to say of British residents—men, women and children.

They are mostly telepathic, especially in summer, and this would be to many alarming and unpleasant. Also they must be prepared for disgusting and offensive sexual attacks.

Disgusted.

Fibre as an Insulator.

In reply to "T. W. H." *re* fuse box, &c., the box is fixed in a subway on iron brackets with air space all round, is provided with a close fitting lid with rubber joint so that no dust can get in, and is on a D.C. circuit; the subway also contains steam and hot water pipes, temperature 50° to 70° F., well ventilated.

Puzzled.

February 15th, 1909.

LEGAL.

The Improved Electric Supplies, Ltd.

On Thursday afternoon Mr. Verey, the Official Referee, delivered his reserved judgment in the action of Muff *v.* Cunnington, which referred to the purchase of the Improved Electric Supplies, Ltd. The hearing was commenced on January 26th, and during the course of the hearing the defendants had withdrawn their allegations of fraud and misrepresention with regard to the book debts.

In giving judgment, the learned Referee said that the first issue raised on the pleadings of the counterclaim was, "Was the stock-book falsely and fraudulently kept, and did it grossly misrepresent the quality and value of the goods therein described?" The evidence was that Thompson kept the stock-book, and he alleged that it represented the cost price. His certificate of October, 1906, said, "Taken by me, or under my supervision, at cost price." The balance-sheet of December 31st, 1906, said, "Stock at or under cost price." Mr. Alison said the items to which Mr. Thompson called his attention represented cost price. In his (the Referee's) opinion, there was no concealment by Thompson, he deceived nobody and no motive for dishonesty was suggested on his part. Some evidence had been put forward to show that the prices were not cost prices, but after considering this and the evidence as a whole, he found there was no dishonesty or fraud in keeping the stock-book, and that it did not misrepresent the quality or the value of the goods. The defendants further pleaded that they were induced to enter into the agreement by the representations contained in the said stock-book produced to them by Mr. Thompson for the purpose of inducing them to enter into an agreement, and that all such representations were false, to the knowledge of the plaintiffs and their servant Thompson, or were made recklessly. As to what took place between Thompson and the defendants at the interview they had there was a conflict of evidence, but it was admitted that after certain correspondence, the defendants saw Thompson and went through the stock-book on two occasions; they also went over the store rooms, and examined the list of customers. Thompson declared that he told them the book was the "basis of cost," but this the defendants denied. Alison's account was that Thompson, pointing to the stock-book, said: "What do you think of that price?" and then pointing to another page remarked, "what do you think of that?" and so on, making it appear how cheap the prices were. They did not discuss, Mr. Alison said, whether the prices represented the market value, and in reply to questions, he said he understood they represented cost price because it was a stock-book. Thompson did not say they were cost price, but he (Alison) inferred it. Though the defendants and Thompson's recollection of what happened differed, he had a letter, dated April 11th, written by the defendants at the time, and that was more reliable. This letter referred to the interview with Cleveland, who had told defendants "to go and see Thompson and the books, and they had done so that afternoon," showing the matter was quite fresh in their minds. It further stated that "They had made a careful examination of the stock in trade, &c, with the result that they were prepared to increase their offer." They did not say in that letter that they had seen the stock-book, and understood that the prices there were current value, nor did they say they "relied upon what Mr. Thompson had told them. They simply said that "they had made a careful examination of the stock-in-trade, &c., with the result that they were prepared to increase their offer." Alison said that they meant plaintiff to believe that they had made a careful examination, and, therefore, doubled their offer, but he since had explained it by saying that he increased the offer because the stock was represented to him as severely written down. Thompson had no interest in the price offered, because it would only pay the debenture-holders and part of the creditors, and leave nothing for him as a shareholder. After April 11th the defendants decided to take over the book debts, and on April 18th themselves took a written offer of £7,500 to Snowden, containing the condition "stock-book a fair representation." There was a direct conflict of evidence as to what happened at this interview on April 18th. Alison and Cunnington asserted that Cleveland said they might rely on the figures submitted by Thompson as to the value of the stock. This Cleveland and Snowden absolutely denied, and they declared that they told the defendants that the liquidator would take no responsibility as to the amount of stock, they would only sell "lock, stock and barrel." Alison would not deny that Cleveland said he must have a clean offer. Whatever was said, the result was that the words "stock-book a fair representation" were struck out. He (Mr. Verey) had come to the conclusion that at this interview there was no representation by Snowden or Cleveland as to the value of the stock. It was proved that the manager of the Consolidated Co., who offered £8,000 for the business, was allowed every facility for examining the books and stock before making his offer, and no reason was suggested why plaintiffs or Thompson should treat the defendants in a different manner. On May 17th the agreement to purchase was signed, and on May 28th a complaint was made by the defendants as to the deficiency in the quantity of the stock; that the stock on May 17th was less than that shown in the stock-book of December 31st, 1906. The only complaint as to value was that made in respect of certain Glasgow stock. He did not find in any of the documents a complaint as to the stock not being of the value shown in the stock-book. As to the book debts, no fraudulent misrepresentation was alleged, but the defendants relied on a warranty. After considering the whole evidence, and the defendants' criticisms in their particulars of the items contained in the stock-book, he had come to the clear conclusion that the defendants acted on their own judgment, and, as

they had written, "after a careful examination of the stock." They were not induced to enter into the agreement of May 17th, 1907, by any representation contained in the stock-book or the schedules, and such representation was not false, nor was it made recklessly. The defendants also relied on the agreement of May 17th as warranty. It was alleged that there was a warranty that the stock on the premises on March, 1907, was of the value and quantity of that stated in the stock-book of December 31st, 1906, and that the book debts in the schedule headed "good" would be paid in full. Was there a warranty or a mere representation? It was proved that neither the solicitor for the plaintiff nor the solicitor for the defendants had seen the stock-book, or knew the contents when the words, "as represented," &c., were inserted by them in the agreement of May 17th. The plaintiffs had previously insisted on striking out the reference to the stock-book in a letter of April 18th, and the value of the stock was a matter of opinion. The defendants had an opportunity of forming their own opinion on the matter themselves. He was satisfied that neither of the parties at the time either intended or understood that any warranty was to be given. As to the contention that the defendants were entitled to recover under warranty, he was satisfied on the evidence that the stock did substantially correspond with the description in the stock-book. It was not proved that the stock handed to the defendants was substantially less than that described by the stock-book of December 31st, 1906. As to the book debts, he was of opinion that the schedule was honestly prepared, and the statement that some were good was an expression of opinion of the vendors upon which the defendants could, and did, exercise their judgment. On the whole of the evidence before him, he found that the words in the agreement were words of description, and neither by such agreement nor afterwards was any warranty given to defendants by plaintiffs of the stock or book debts. Defendants also claimed damages for breach of a collateral agreement of May 17th, under which the plaintiff, Muff, appointed them general managers on his behalf until the approval of the Court and the contract of sale had been obtained. Defendants went into possession of the premises, it being expected at that time by all parties that the consent of the Court would be obtained and the purchase carried out. Defendants, who considered themselves at that time as purchasers, sent out circulars informing the customers of the plaintiff that they (the defendants) had bought the business. In his judgment, such a proceeding was not calculated to protect the goodwill of the plaintiffs in case the sale to the defendants had fallen through, and he came to the conclusion in all the circumstances that the defendants in so acting justified the plaintiffs terminating their management and taking possession, and that the defendants were not entitled to claim any damages in respect thereto. He must therefore give judgment for the plaintiffs on the counterclaim, with costs.

Mr. Dwyer pointed out that the plaintiffs had forced them to bring the action before a jury, and that the learned Judge had remitted it to the Official Referee, therefore, all those costs had been thrown away. He asked the Official Referee to make some allowance in respect of those costs.

The Official Referee said he could not interfere in the matter.

Mr. Acland said there was another action—Muff *v.* Cunnington—for an account, and he suggested that that should be adjourned *sine die*, as there was no doubt the matter was one which could be arranged between the parties.

In the result, the Official Referee adjourned that action generally.

The Maatschappij van Radiotelegraphie *v.* Marconi Wireless Telegraph Co., Ltd.

The hearing of this action was commenced on Monday before Mr. Justice Bray without a jury in the Commercial Court of the King's Bench Division. Mr. Gore Browne, K.C., and Mr. Whateley appeared for the plaintiffs, and Mr. Scrutton, K.C., and Mr. Disturnal represented defendants.

Mr. Gore Browne said this was an action upon three bills of exchange drawn by plaintiffs and accepted by defendants. They were dated December 1st, 1907, and were due at six months, and therefore became payable on June 4th, 1908. They were for £500, £500 and £300, and were accepted by Mr. H. Cuthbert Hall, the then managing director of the company, and countersigned by the secretary, Mr. Hy. W. Allen. The defences put in were that Hall had no authority to bind the company, that there was no consideration, and that there was misrepresentation. He proposed to put in the bills, the memorandum and articles of association of the defendant company showing that they had power to make bills, that the directors had power to delegate that authority to the managing director, and that Mr. Cuthbert Hall was managing director, and then to leave the defendants to make out their case.

Evidence having been given proving the bills,

Mr. Scrutton, for the defence, said he appreciated the reason why plaintiffs had taken this course. He was not surprised that they were keeping Mr. Weiss out of the witness box as long as they could. When he had opened his Lordship would see why Mr. Weiss was not put in the box, and he should object to plaintiffs calling any further evidence.

His Lordship said plaintiffs would be entitled to call any further evidence to rebut any charges of fraud or misrepresentation. It was for defendants to prove no consideration.

Mr. Scrutton said his first point was that Mr. Hall had no authority to make the bills in question. Accounts had been put in showing these bills appearing as liabilities of the company, but during the period covered by these accounts there was a quarrel going on between Mr. Hall and the directors as to a question of policy which resulted in Mr. Hall leaving the company on March 3rd, 1908. When he left, a sub-committee of investigation was appointed, and it took them some time to find out matters with which he had been dealing without their knowledge. When they found the real facts they repudiated the bills, and the directors had never seen these entries. At that time the defendant company were in the course of forming various subsidiary companies to deal with their invention in various countries. Mr. Weiss had certain concessions in Holland which he had been trying to float into a company, and this was the second case in which he and the defendant company had been in the Courts. On April 10th, 1907, Mr. Hall and the secretary signed, subject to the approval of the board, an agreement with Weiss, as promoter, which said that he should within three months form a limited company in Holland with a capital of 540,000 florins in 540 shares, and before it was registered he should obtain the approval of the English company to its statutes and directors, and if such consent was not obtained the agreement was to be null and void. The English company were to sell, and the promoter was to procure the Dutch company to purchase certain rights, the consideration to be the allotment and issue of 270 fully-paid shares. The promoter was to have 150 fully-paid shares. The English company was always to have the right to nominate one director, and the purchase was to be completed on July 1st. That date was afterwards altered to November 1st. The Dutch company was formed, and defendants said that they had never approved its articles, and that therefore they were not liable for these bills. They only approved articles in a company in which they were to have the majority of shares, and in which they were to have the right to nominate a director. The articles of the company actually formed contained no reference to the name of the Marconi Co. or to the other powers which they were to have. These bills were given for a subscription of 18 shares beyond the 270, which were to be allotted as fully paid.

Evidence was given by directors of the defendant company, and the case was adjourned.

On Tuesday, February 16th, Mr. H. W. Allen, secretary of the defendant company, gave evidence for the defence in regard to the discrepancies between the statutes of the Dutch company as sanctioned by the directors of the defendant company, and the statutes of the company when formed.

Cross-examined by Mr. Gore Browne, he said the principal difference that he noticed was that there was no reference in the statutes of the plaintiff company to the Marconi Co. It was not even mentioned by name, and the company did not specifically become a shareholder in the Dutch company from the beginning. He noticed that at the time. Witness acted under Mr. Cuthbert Hall's instructions in signing the bills in question. In the ordinary course of business he acted under Mr. Hall's directions, but he expected that Mr. Hall would have specifically mentioned the matter to the directors. The bills were entered in the bill book, and the financial statements were usually read out at the directors' meetings. Up to March, only the totals were read, but in March the statements were read in detail. The chairman, however, had the statements and copies on the table. Witness did not think there was any concealment from first to last on the part of Mr. Hall regarding these bills, or he would have mentioned the matter to the directors. He should say the directors knew about the bills on March 30th, and then they said nothing about them, because they had not seen the statutes at that time. Pressed by counsel, witness said the directors must have seen the statutes by that time.

Questioned by the Judge, he said that on April 23rd the directors knew all about the differences in the statutes.

Did you ever write to the Dutch company and ask for an explanation of the discrepancies in the statutes?—We did not write, but Mr. Weiss (the promoter) was over here, and he was seen on several occasions.

Further questioned, Witness said he could not remember any minute of the board declaring the agreement to be void in consequence of the differences, but notices were given terminating certain agencies in Holland. He had never asked Mr. Hall if he approved the statutes. It was a matter of opinion whether Mr. Hall left the company on amicable terms.

Mr. Scrutton remarked that there was an action pending between Mr. Hall and the company, and Mr. Hall was in court helping the plaintiff company.

Mr. Chubb, solicitor for the Marconi Co., gave evidence as to certain interviews with Mr. Weiss, in which the statutes were discussed. He said he never saw the new statutes until April 22nd, 1908.

This concluded the evidence for the defence.

Mr. Gore Browne then called rebutting evidence.

Mr. Cuthbert Hall said he was managing director down to March, 1908. He negotiated this matter with Mr. Weiss entirely, and the directors took no part whatever in the negotiations. They left it absolutely to him, and he reported to them what was going on. On several occasions Mr. Weiss attempted to refer from his decision to the directors, and the directors always referred Weiss back to him. Nothing was concealed from the directors, Weiss explained to him all the alterations that had been made in the statutes according to Dutch law, in order to get the Royal Assent, and witness approved and agreed to them, not regarding them as very material. He knew before that some alterations might have to be made. The directors never took any interest in the statutes. He accepted the bills sued on in the ordinary course of business. It was quite incorrect for the directors to assert that all January and February, 1908, were occupied in discussing differences of

policy with himself. There were differences, but they had nothing to do with this Dutch contract. They related to finance and questions of finding large sums of money, so that it was difficult to believe that the financial statements were not discussed by the directors.

In your opinion were the changes in the statutes material to the injury of the defendant company?—No, certainly not. The best control available of the company is the holding of the majority of the shares. That was the policy I suggested in the first instance, and which the directors carried out at my suggestion. It was not a policy which was pressed on me.

Cross-examined by Mr. Scrutton, he thought that Mr. Justice Kekewich was quite unjustified and unwarranted in saying that his evidence in a previous action of Lloyd's *v.* Marconi was not to be relied on, and many other people agreed with witness that he gave his evidence most fairly.

Counsel having addressed the Court, his Lordship gave judgment. He said in his opinion it was quite clear that there was authority for Mr. Hall to sign the bills. He was satisfied that the financial statements showing the liabilities of the company were submitted to the directors at the meeting of the board, and these statements included the bills. If Mr. Hall had no authority, the directors would be asked for an explanation with regard to the plea of misrepresentation. He would accept Mr. Hall's statement that Mr. Weiss informed him of the alterations in the articles of association. With regard to the other plea of no consideration, the directors knew that the company had, in fact, been formed, and it was in that company that they agreed to take the shares. Therefore, the plea of no consideration failed. He was satisfied that the managing director, Weiss, was entitled to alter the articles according to the requirements of the Dutch Government. The defendants had failed on all these pleas, and, therefore, there must be judgment for the plaintiffs for the amount claimed, viz., £1,221. A stay of execution was granted.

L.C.C. *v.* Edwards (Surveyor of Taxes).

Mr. Justice Channell, in the King's Bench Division on 10th inst., dismissed the appeal of the London County Council in the revenue case of that authority *v.* Edwards (surveyor of taxes). The case (says the *Financial Times* report) raised a question in respect of depreciation by wear and tear of tramways south of the Thames. Upon the electrification of the system, the County Council complained that the Commissioner of Inland Revenue had refused to make adequate allowance during the 12 months ensuing from the date of the conversion of the system.

His Lordship dismissed the appeal.

Joseph Richmond & Sons *v.* W. H. Lorden & Sons.

In the Official Referee's Court of the High Court of Justice on Tuesday and Wednesday, before Mr. Verey, plaintiffs, electric lift makers, sued defendants, builders, of Trinity Road, Upper Tooting, for the sum of £79 10s., balance which plaintiffs alleged was due on an account for the construction of an electric lift on defendants' premises. The lift was constructed in March of last year for a sum of about £250. Defendants refused to pay the sum claimed on the ground that the work was incomplete and defective, and, among other faults, they complained that the lift was too noisy, and there was too much vibration.

Mr. Whateley appeared for plaintiffs, and Mr. Todd was counsel for the defence.

Witnesses were called by the plaintiffs to refute the various complaints by defendants.

Mr. Burnett, formerly assistant manager to the plaintiff company, said it was quite possible that a bearing of the stuffing box type would get hot if the cotton packing was allowed to get hard and the bearing was screwed up too tightly. Further questioned, Witness said that the electrical contacts in the motor house were bound to get burnt with use, but he denied that the switches were made with soft metal. Hammered copper was used, but, of course, if the contacts were allowed to be unduly burnt through improper use, the metal would soften. If the attendant used the switches improperly by breaking contact too quickly, it would cause "arcing" and fusion of the metal, thus softening it. A competent electric lift attendant would not do that, but would use his switches so that burning of the contacts would be reduced to a minimum. Of course, as he had said, these contacts were bound to burn with use, and on the London tube railways he believed men were employed to do nothing else but go round and replace burnt contacts on switches.

Cross-examined, Witness denied that the lift in question was in such a state as to frighten nervous people. He was much surprised to hear that when the lift was tested the other day with ½ ton weight the noise was deafening, and the lift vibrated in such a way as to make a nervous person believe that an accident might happen. He agreed it was the duty of the manufacturer to have a lift so adjusted that it would not get out of order when carrying the maximum load. In this case his firm desired to do so, but defendants wished that the lift should be left balanced so as to take an over load. It was no part of witness's duty, when he visited the lift, to inquire into the competence of the lift attendant, but on several occasions he saw the lift when it was only in charge of a boy, and once when the lift attendant was working it he allowed the cage to overrun on to the top of the cut-out switch. No competent liftman would have done that. The contract states that all the materials were to be of the best quality and to the defendants' satisfaction. Witness was sure that the materials used were as required, and the defendants' representative expressed his satisfaction when the lift was taken over on March 31st. No complaint at that time was ever made about "bumping" and "vibration." It was true there was some noise. He denied, however, that when they were in the cage at the test and heard the noise, any vibration was felt. With an electric lift if there were any vibration, it was nearly always in the gear. The noise the gear made would be transmitted down the ropes, and thus become apparent to those in the cage, but no vibration would be felt. He denied that the controller or the starting switch in the cage were quite unsuitable to the lift, and would continue to be a source of trouble, however much they might be repaired. The whole job was a first-class one, and there was nothing inferior either in the workmanship or the material. The vibration in the gear was probably caused by an abrasion on one side of the teeth of the gear-wheels. Such an abrasion might be caused by grit getting into the wheels.

Mr. Marryat, a member of the firm of Messrs. Marryat & Place, electrical engineers, stated that his firm entered into a maintenance contract for the lift in question. If they had inspected the lift, say, once a week, that would have obviated the stoppages. It was a mere matter of adjustment. There was no electric lift against which complaints could not be made. With very heavy and continuous work, there was no electric lift which was absolutely proof against breakdowns. Noise always came eventually with electric lifts. This was quite an average electric lift.

Cross-examined: He thought the controller was sufficient for the work the lift had to do. He considered that the lift had an exceptional number of journeys to perform per day. He should consider the lift ought to perform satisfactorily 15 journeys per hour, with a full load of ½ ton. If the worm-wheel had been ground in by actual use, it would have worked without noise and vibration. Considering the work the lift had to do, the controller wanted constant attention; if a more powerful controller had been supplied, that would have been obviated to a large extent. He had tested the lift with a ½-ton load, and there was a great deal of noise. A purchaser would require that to be remedied. The grinding in ought to be done in 600 journeys. The lift required his attention once a week.

Mr. P. A. Sharman, consulting engineer, examined, said he had inspected the lift and had read the reports and the contract. He should describe the work the lift was required to do as heavy, but he considered the controller was a perfectly proper one. He agreed entirely with the evidence of Mr. Burnett. The complaints involved a mere matter of adjustment. A lift attendant could do minor matters of adjustment. He agreed with Mr. Marryat as to the cause of the noise. All electric lifts were subject to vibration more or less.

The hearing was concluded on Wednesday. Mr. Todd having opened for the defence, Mr. Henderson, Messrs. Lorden's lessee of the premises in which the lift was situate, Mr. E. Pittaway, the lift attendant, and Mr. Gilbert Rosenbusch, a lift expert, gave evidence. The Official Referee then reserved judgment in order to make a personal examination of the lift.

Attorney-General *v.* West Ham Corporation.

In the Chancery Division on Tuesday, Mr. Justice Neville had before him on motion this action, which raised a question of the Corporation's right to use a rate for the payment-off of a bank overdraft, said to have been created in connection with the municipal electric lighting. Mr. MacMorran, K.C., and Mr. Joshua Scholefield appeared for the plaintiff; and Mr. Danckwerts, K.C., and Mr. Morton for the defendants.

In opening the case, Mr. MacMorran said that it came before the Court upon a motion by the Attorney-General at the relation of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., for an interim injunction to restrain the Mayor, Aldermen and Burgesses of the Borough of West Ham, until the trial or further order, from making, enforcing or receiving payment of any rate for the purposes of paying any overdraft or interest on any overdraft at their bankers, the London and County Bank. The action raised a question of considerable importance. The overdrafts in question were overdrafts which appeared in the accounts of the Corporation published for March 31st, 1908. These accounts, he should show, included accounts as required by the Electric Lighting Act of 1882, and were furnished in accordance with the requirements of that Act. There was cash due to the bankers on capital account £90,949 4s. 4d., and on revenue account £44,952 12s., making £135,900 odd. The suggestion on the part of the relators was that this represented an unlawful, or rather an illegal, borrowing, a borrowing without due sanction as required by Act of Parliament. As to the other part of the claim, it related to interest in connection with the overdraft, and appeared to amount to £3,570 on capital account and £1,647 on revenue account.

Mr. Justice Neville: What you are seeking to restrain is a rate being raised for an illegal borrowing on the part of a local authority?

Mr. MacMorran said that was so; an illegal borrowing under the Electric Lighting Act of 1882, the local Acts and the provisional orders. The defence was that this was a mere book-keeping entry, and there was, in reality, no overdraft at all. The defendants contended that they were entitled to have his Lordship look into the whole of the accounts to see whether they were in credit at the bank or not. His submission was that the Court must deal with the electric lighting accounts as they appeared in the balance-sheet, and with regard to the electric lighting, must deal with the Corporation as undertakers of a separate matter. It was not intended that the other accounts should be dealt with to see whether the electricity cost was paid out of the borough funds. On

the balance-sheet as issued by the Council, there was an overdraft that was not authorised by Act of Parliament, and he submitted he was entitled to restrain the making of a rate to meet that overdraft.

Mr. Danckwerts: The bank manager has put in an affidavit in which he says there is no overdraft.

Mr. MacMorran said they would deal with that when they came to it.

Mr. Danckwerts said he did not know whether his Lordship was aware the stage the action was at. The whole thing was ready for a speedy trial.

Mr. MacMorran said it was not so. They desired discovery, and there were a lot of other things to be done.

Mr. Justice Neville asked whether it was necessary to have a lengthy discussion now, when the action was nearly ready for trial, and would be tried upon different evidence from that which was now before him.

Mr. MacMorran did not dispute that the evidence was different, but he asked to be allowed to open the motion to the extent of enabling his Lordship to form an opinion as to the necessity for interlocutory relief.

His Lordship said that if the Corporation would undertake to keep matters *in statu quo* until the trial, he did not see the necessity of hearing the motion.

Mr. MacMorran said that if they would undertake to keep matters *in statu quo* he could not, of course, ask for anything more than that.

His Lordship to Mr. Danckwerts: Are you willing to give such an undertaking?—Mr. Danckwerts said it was a practical impossibility, because the whole of the accounts with which the plaintiffs were quarrelling had been worked out long ago.

Mr. MacMorran said that all he wanted was an undertaking not to pay this particular overdraft.

Mr. Danckwerts: It is no overdraft at all.

Mr. Justice Neville: Of course that is the matter in dispute.

Mr. Danckwerts said that he was quite agreeable that the motion should stand over until the trial, costs being reserved, and, moreover, he would undertake to conduct the business and carry it on in a regular way, and he could say the Corporation would not use the rates in a way that was illegal.

Mr. Justice Neville: Then it would be a question of allocation.

Mr. MacMorran said that what the plaintiffs submitted was that certain accounts had been published with reference to the electric lighting undertaking which showed a large overdraft, and the Corporation had no right to have any cash due to the bank for any consideration whatever. The Corporation said taking the whole of the accounts there was no overdraft; therefore, with regard to this particular undertaking, it was a mere paper thing. If the Corporation would give an undertaking that no money should be applied in working off what was called "cash due to the bank" until the trial, then the purpose of the motion would have been obtained. They could borrow what money they liked if they did not come upon the ratepayers to recoup them. Under the Electric Lighting Act of 1882, provisions were made by the Board of Trade with regard to a number of bodies, and amongst them were local authorities, for the supply of electricity. A provisional order was made authorising the Corporation of West Ham to supply electricity within their district; any expenses incurred by the local authority under the Act, including any expenses for obtaining any licence, order, or special Act, should be defrayed out of the local rate, and the Corporation have power to cause such rates to be levied for the purpose of defraying such expenses. Such expenses were to be admitted to be special expenses under the Public Health Act. His Lordship would follow that so far there was provision for obtaining the money as it was required. Sec. 8 was the borrowing section. That provided that a local authority might, from time to time, borrow under such provisions and restrictions as to repayment of loans as set forth in the schedule of the Act. That meant that they required the sanction of the Local Government Board. It was sufficient for his purpose to say that, for the purposes of the Act or for the purpose of supplying electricity, the local authority could not borrow money except with the consent of the Local Government Board, and then only for permanent works. The West Ham Corporation obtained their provisional order in 1892, and it was confirmed by a special Act of the same year (Ch. 55 and 56 Vic.). That Act contained a provision that the moneys received by the undertakers, except borrowed moneys and moneys arising from the disposal of land, might be applied in the payment of working expenses, establishment expenses, cost of maintaining the undertaking, payment of interest or dividends on stock or other security in respect of money borrowed for electrical purposes, provision for a sinking fund, invest any balance in trust securities until the fund had reached one-tenth of the aggregate capital, and after making provision for any extraordinary claim, apply the balance to the credit of the local rate or general district rate, or, at their option, apply it for improving the district, provided always that the price of energy should be reduced so as to reduce any surplus to the amount of 5 per cent.; any deficiency on any one year to be charged on and payable out of the local rate. As his lordship would see, the scheme was, and the receipts of the undertaking were, to be applied first for the payment of working expenses, then the payment of interest or dividend, then for providing a sinking fund, payment of all other expenses not properly chargeable on capital, and after paying all these things if there was a surplus, it was to go to the local rate or the improvement of the district. The point was this—the undertaking meant the electrical undertaking carried on, which was a separate undertaking quite apart from any other undertaking whatever. Its only connection with the local rates was that any surplus went into the local rates and any deficit came out of the local rates of that year. The West Ham Corporation under the Electric Lighting Act of 1882 had prepared accounts for the year—they had to make up their accounts in a prescribed form and present them to the Board of Trade—and those accounts showed an overdraft which the plaintiff said was illegal. Altogether, taking revenue and capital account, they showed an amount owing to the bank of £135,901 16s. 4d. This the plaintiffs said represented money borrowed for the purposes of the undertaking over and above that for which the sanction of the Board of Trade had been obtained, and was therefore an illegal borrowing which the Corporation had no power whatever to make. As to the interest on the overdraft, that the plaintiff said represented the payment of interest on an illegal borrowing which had been going on for some years, and now they sought to restrain them paying it. The Corporation were in this dilemma. This was a statutory account rendered under Sec. 9 of the Act of 1882, and whether it was a correct statement or not they must assume it to be correct. That account showed that the electric lighting undertaking had borrowed from the bank money which they were not authorised to borrow. The defendants set up the ingenious plea that they kept all their money in one stocking, and that so long as there was money there they could draw upon it. It was only by bringing in other accounts that it could be suggested that there was not a deficit on the electricity accounts. The learned counsel then proceeded to read at length the evidence filed in support of the motion, at the conclusion of which his Lordship said that he thought it was a case for a speedy trial, but that he ought not to interfere by way of interlocutory injunction. If he now granted the injunction asked for, it might have the effect of throwing a public lighting concern into disorder. As the case might come on for trial in a very short time, he thought he might let the motion stand over until the trial. Either party might have liberty to apply to advance as soon as the action was ready for hearing.

Mr. Danckwerts said he wished to say at once on behalf of the Corporation that they were really not indebted to the bank at all. The indebtedness existed merely in the imagination of a gentleman for whom he had the highest respect, and whose respect he hoped to retain.

The motion was accordingly ordered to stand till the trial, costs being reserved.

Santoni Arc Lamp and Engineering Co., Ltd., v. Beaty Bros., Ltd.

In the City of London Court, on Tuesday, before his Honour Judge Lumley Smith, K.C., the plaintiffs sought to recover £60 for electric lamps supplied to the defendants, tailors, of Liverpool. Mr. Valetta appeared for the plaintiffs, and Mr. Proctor for the defendants.

Plaintiffs' case was that the defendants ordered 12 Santoni arc lamps, which were to be used for advertising purposes. They were to be fixed outside defendants' premises. The wiring and installation work was carried out by Messrs. Bird, of Liverpool, and for that the defendants had paid. The plaintiffs guaranteed to supply their latest pattern, and that had been done. They sent the lamps to Liverpool, and when their man went to fix them it was found that there was some difficulty in getting the necessary current supplied, the Liverpool Corporation raising some objections. The lamps could not be tested, and then the defendants rejected the plaintiffs' lamps altogether, getting others elsewhere. The lamps were now thrown on plaintiffs' hands. Defendants had said that the lamps supplied did not weigh as much nor look as long as those ordered.

Mr. Santoni, plaintiffs' managing director, said there was nothing to complain about the lamps. He admitted that he had not supplied defendants with the exact lamp specified, but it was better, and gave a better light at less expenditure. There was a saving of 75 per cent. in carbons. It was a smaller lamp with greater efficiency.

For the defence, Mr. Chas. Aberdeen, secretary of defendant company, said they had not had supplied to them the lamps ordered. It was not a flame arc lamp as specified. They had to buy lamps elsewhere, and they refused to take the lamps sent by the plaintiffs.

Mr. T. L. Miller, M.I.E.E., &c., said the lamp supplied was not a flame arc light, and it was not as efficient as the lamp selected by defendants. There was not the same distribution of light.

Judge Lumley Smith said defendants had had some lamps made by plaintiffs' predecessors, and they wanted some more. The plaintiffs might have supplied a lamp which was more up-to-date, but it was not what was ordered. How were the defendants to know that a fresh and different pattern had been put on the market? The lamp sent might have been better, but plaintiffs must run the risk of having them refused. There had been a good deal of evidence to show that there was a considerable difference in the appearance of the lamps. On the whole defendants were entitled to stick to their rights, and were entitled to reject the lamps sent. Judgment for the defendants, with costs. It might be a hard case on the plaintiffs, but he could not help that.

International Congress of Chemistry.—The seventh triennial congress will be held in London at the end of May, and a very large attendance is expected. There is a section which deals with electrochemistry.

NITROGEN FROM THE AIR.

While for the last 10 years the chief incentive to the invention of an efficient method of fixing atmospheric nitrogen has been the desire to produce a fertiliser in quantity for wheat-growing areas, there is in addition a multitude of manufacturing purposes in which there is a great demand for nitric acid all the world over. These include, for example, such industries as the manufacture of dynamite, cordite, nitro-glycerine and smokeless powders, celluloid, artificial ivory, indigo, coal tar products, nitrate of silver, electro-plating, &c.

The successful production, therefore, of pure atmospheric nitric acid will more than solve Sir William Crookes's great wheat problem, not only by enlarging the industries indicated above, but probably also by creating a great number of others for which pure nitric acid is indispensable.

A system by which this is likely to be satisfactorily accomplished, and which, by present results, appears to go far towards fulfilling Sir William Crookes's ideal of 1898, was originally devised almost immediately after Sir William's memorable address on the world's wheat supply. The electrical experiments commenced with a number of small tests, using a plant of 100 H.P. A transformer of 75 KW. transformed alternating currents of 3,600 volts and 50 periods to 50,000 volts. A tower was used as a "flame receptacle," and a common electrode for all flames was a well-insulated aluminium shaft suspended in the centre of the tower. Air was conveyed to the combustion tower by apertures below, and thereafter to the absorption plant. The installation was constructed for continuous working at 50,000 volts.

Based upon these experiments, which extended over a number of years, an entirely new system of furnaces and absorption plant has been evolved. The old furnaces have been superseded, and new furnaces designed with an entirely different arrangement of electrodes, and containing surface coolers for cooling the hot gases instantaneously after passing through the electric flame, in order to prevent the decomposition of the nitric oxide formed in the flame.

The gases from the furnaces contain 2·5 per cent. of nitric oxide (NO), and, still at a temperature of about 700° C., pass into the oxidising tower, where they are left in contact with oxygen; at this temperature the nitric oxide is quickly transformed into red fumes of nitrogen peroxide (NO_2) by taking up oxygen from the air. This gas readily combines with water, forming nitric acid. This is effected by passing the furnace gases through a series of absorption towers containing finely divided material, which is kept wet by a constant trickle of water. The arrangements of the absorption apparatus make it possible to produce nitric acid uncontaminated by the lower oxides of nitrogen, but as water cannot absorb nitric acid to a greater extent than 60 per cent., it is necessary to stop the absorption process at this point and effect the further concentration by distillation.

The electrical part of this installation consists of a newly-designed furnace, one of the features of which is the combination of the magnetic field with the electric flame, in such a way that the arc flame is deflected by the field.

The results of tests under the methods briefly indicated above show a minimum output of at least 60 grammes of HNO_3 per KW.-hour for a furnace of this kind, with the comparatively small power employed. This result has since been improved upon. The furnace has proved to be well adapted for alternating as well as continuous current. Trials with continuous current have been found successful with a pressure of 1,500 volts. The output has been considerably increased by enriching the air with oxygen, a view long held by Sir William Crookes. It has also been proved that the output of HNO_3 is increased by accelerating the velocity of the air passing through the flame.

Apart from the loss of energy in the turbine and dynamo (which is accounted for in the cost of generating energy), 99 per cent. of the total energy produced is utilised in the electric arc flame, no auxiliary apparatus being required other than the magnetic coils, which in a furnace of 500 KW. scarcely consume 1 per cent. of the available energy.

Numerous tests and experiments have given rise to other and later improvements, and with still more satisfactory results. But the great objects attained have been the simplification of the methods of production, and the reduction in cost of working, and wear and tear, with a correspondingly increased output of nitric acid. Practically all the nitro oxides which leave the furnace are absorbed, and an allowance of only 1 per cent. has been considered sufficient for those not absorbed.

As regards the chemical features of the process, it has been found that 95 per cent. of the nitric gases are changed into nitric acid at a very low cost, only the remaining 5 per cent. being absorbed by alkali solutions.

The comparative smallness of the furnaces required is a special feature of this system; a practical unit is a furnace of 500 KW. in an installation of limited size. These, of course, may be multiplied to any extent, and the amount of electrical power capable of being used in one furnace may be said to be unlimited.

When the present new installation is complete it is confidently expected that even better results will be obtained, the new furnaces being specially designed for high efficiency and for increased rapidity in cooling the heated gases.

The system referred to is that of Mr. Moscicki, the inventor and patentee of the high-pressure condensers which are now being largely adopted by the War Office as well as by the Admiralty in connection with field and naval telegraphy on the wireless principle. Mr. Moscicki's condensers are also used in his system of nitric acid production, and play a unique and important part in conjunction with the other novel features of the system; these condensers have been described by Prof. Fleming as the most efficient substitute for the Leyden jars hitherto generally used, as they can withstand pressures as high as 60,000 volts, whilst 20,000 is about the maximum of the ordinary Leyden jar.

The commercial development of this system for England, Norway, the principal countries on the Continent, the United States and Canada, as well as the Commonwealth of Australia, is in the hands of a body of English gentlemen of experience, who have long had at their disposal for the purpose a large amount of available water power at present adequate to the prospective needs of a great industry. Associated with them in sympathetic co-operation is Sir William Crookes, F.R.S., who may be fittingly termed the parent of the project, and other well-known electrical experts. The engineers—who are also financially interested in it—are Messrs. Shone & Ault, 47, Victoria Street, Westminster.

BUSINESS NOTES.

For Sale.—The Aberdeen Corporation Electricity Department, as announced in our advertisement pages to-day, is offering two steam boilers for sale.

Catalogues and Lists.—The Bastian Meter Co., Ltd., Bartholomew Works, Kentish Town, N.W.—Eight-page pocket pamphlet stating the special advantages of the Bastian electrolytic meter, briefly describing its construction and action, and giving code-words for various sizes and pressures.

Messrs. Alfred Herbert, Ltd., Coventry.—Second edition of Section C2 of their catalogue, giving in 12 pages an illustrated description of the Coventry patent concentric chuck, embodying a new departure in the design of self-centring chucks by which, it is claimed, the troubles experienced with geared scroll chucks through weakness of bodies, breaking of pinions and scrolls and excessive wear are avoided.

The Cambridge Scientific Instrument Co., Ltd., Chesterton Road, Cambridge.—Price list of Méker burners and furnaces. The burner is a greatly improved form of Bunsen burner, in which the proportions of air and gas are adjusted to give the highest possible temperature, the flame being prevented from flashing back by a deep nickel grid. With this burner and a Méker furnace even copper can be melted without an air blast; and if the latter be employed, a temperature of about 1,800° C. can be maintained.

The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Aston, Birmingham.—Wall show-card of the "Eclipse" electric heaters. The design is an attractive one, which impresses one with an idea of the warmth and comfort that it is possible to obtain with these radiators in private residences and so forth.

Messrs. W. Geipel & Co., 72A, St. Thomas Street, S.E.—List of high-grade and durable vulcanised rubber-insulated wires and cables (classes A and B) such as they are supplying to railway companies and other large establishments.

Mr. William Whittaker, Yorkshire Street Ironworks, Burnley, Lancs.—28-page well-illustrated catalogue containing descriptive and operating particulars of his patent mechanical stoker and box-girder self-cleaning fire-bars. A number of testimonials from mill-owners and engineering firms who are users, appears at the end.

Messrs. Julius Sax & Co., Ltd., 100, Charing Cross Road, W.C.—New catalogue, with a strikingly blue cover by which it will always be easily recognised, containing illustrations, neatly set out, of a large number of electric light accessories, such as ceiling roses, fuses and fuse-boards, switches, cut-outs, lampholders, wall-plugs, insulators and so forth. Prices are clearly shown. We understand that most of the apparatus is of English manufacture, and wherever possible the articles are made up with English vitreous china, which has high insulating properties, and is particularly suited for damp situations. Copies will be sent on receipt of trade card.

The Birmingham Carbon Works, Witton, near Birmingham.—Pamphlet relating to Apostle, Nubia, Witton brand, and flame carbons, and tabulating sizes and prices. Of course all these carbons are Engli-h made.

Messrs. Marples, Leach & Co., Ltd., Adnil Building, Artillery Lane, E.C.—8-page abridged illustrated price list of Adnil arc lamps. Particulars of the "Prima" flame lamp, and the "Rebofa" vertical flame lamp are first given. The "Rebofa" lamp works with impregnated carbons arranged vertically and superposed, and with the small voltage of about 30 volts per lamp, permits of six lamps being connected in series on 200 volts. "Regina" enclosed type lamps follow, which are constructed on the one working part principle, the carbon holder, clutch, and dash-pot, and also the magnet core, being combined to form the one working part. The lamps have a hermetically-closed chamber, which is claimed to give a long burning life combined with an even brilliance of light throughout the whole life of the carbons. The "Helia" "Reginula," and other types, as well as searchlights and projectors, are also listed. Samples of all the lamps can be seen working in the firm's showrooms.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet describing his new accumulator discharge meter for measuring the capacity of ignition batteries.

Sun Electrical Co., Ltd., Charing Cross Road, W.C.—Price-card of thermo-blink flashers.

Messrs. Bagshawe & Co., Ltd., Dunstable.—Illustrated leaflet giving prices of their "B.B." bushed chains.

Messrs. Wallach Bros., Royal London House, Finsbury Square, E.C.—New catalogue of 200 odd pages showing, and stating prices of, a great variety of manufactures and stores for engineers and engineering purposes. Steam fittings, tools, drilling machines, pulley blocks, ropes, shafting, safety appliances, asbestos and rubber goods, pumps, &c.

A specimen of a simple and inexpensive desk file, in which to keep one's papers a little bit in order, has been sent to us by Messrs. Spicer Bros., Ltd, paper makers, of 19, New Bridge Street, E.C.

Single-phase Railways Equipped with Siemens Apparatus.—We have received the following tabulated particulars of single-phase railways that have been equipped with Siemens apparatus:—

Name of line.	Line voltage.	Frequency.	Length of line in km.	Electric equipments for motor coaches.	Electric equipments for locomotives.	No. of motors.	H.P. per motor.	Total H.P.	Date of opening.
Murnau-Oberammergau	6,000	16	26	4	2	10	100	1,000	Beginning of 1905.
						2	175	350	
Swedish State Railway	20,000	25	—	—	1	3	110	330	July, 1905.
Vienna-Baden	550	15	65	19	—	80	60	4,800	May 1st, 1907.
				1		2	30	60	
Blankenese-Hamburg-Ohlsdorf ...	6,600	25	65	6	—	13	175	2,275	Jan. 29th, 1908.
Rotterdam-Hague-Scheveningen ...	10,000	25	76·5	25	—	54	175	9,450	Oct. 1st, 1908.
Midland Railway	6,600	25	33·5	2	—	5	175	875	April 13th, 1908.
Seebach-Wettingen...	15,000	15	21·5	—	1	6	225	1,350	Dec. 1st, 1907.
Roma-Civita-Castellana	6,000—500	25	—	4	—	20	40	800	Dec., 1906.
Parma Provincial Railway ...	4,000—400	25	60	10	—	24	60	1,440	In preparation.
St. Pölten-Mariazell	6,600	25	106	—	13	28	250	7,000	Under construction.
Experimental Loco.	10 000	15	—	—	1	2	500	1,000	In preparation.
Wiesental Ry., Basel-Schopfheim	10,000	15	60	—	10	24	500	12,000	" "
Spiez-Frutigen	15,000	15	19·9	3	—	8	225	1,800	" "
Vacz-Budapest-Gödöllö	10,000	15	58	11	4	36	175	6,300	" "
Total (to end of 1908) ...			591·4	85	32	318	—	50,830	

Prize Competition.—The Société Industrielle de Mulhouse has offered prizes for the following:—Method of driving printing machines, &c., at speeds variable over a very wide range, with three-phase motors at constant pressure and frequency, the efficiency and power factor being never less than 0·4; comparative study of the respective merits of mechanical and electrical driving for textile mills; cheap automatic circuit-breaker or cut-out which shall carry for at least 15 or 20 seconds a current three or four times the normal, but shall with certainty interrupt a current 30 per cent. above normal after not more than 10 minutes—for use with small motors; a fusible cut-out for 20-30 amperes at 250-500 volts, which shall fulfil certain specified conditions, to be found in *l'Industrie Electrique* for January 10th, 1909.

Patent Restoration. — The Controller has made an order restoring letters patent No. 19,477 of 1899, granted to John Frederick Simmance and Jacques Abady for "Improvements in street lighting apparatus."

Osram Lamps in Germany.—Following on the drop in price for 200-volt lamps, mentioned in our last issue, there has been a reduction in the price of 100-130-volt Osram lamps of 16 H.C.P. (14½ C.P.), consuming 18 watts, to 2s. apiece, gross price, as from the 15th inst. For series running the price is 3d. higher, and the quantity available for this purpose is limited. This information is embodied in an advertisement in the *E.T.Z.* by the Deutsche Gasglühlicht Aktiengesellschaft.

Electrical Enterprise in Turkey.—According to the *Westminster Gazette*, Mr. Robert Hammond has just returned from Constantinople, where he has been conferring with members of the Government, and speaks hopefully of Turkey as a field for British electrical enterprise. "The one or two places that are lighted by electricity in Constantinople have obtained the machinery surreptitiously. The Pera Palace Hotel, for example, utterly failed to get an electrical generator through the Customs as long as it was described as a dynamo. So they telegraphed to Germany for another generator, which was taken to pieces and labelled as coffee machinery. This they had no difficulty in passing through the Customs, and they told the officials that the dynamo might be sent back, as they had found another way of making electricity. Under the new *régime* more enlightened views prevail, and Mr. Hammond believes that immense business is to be done in Turkey by the introduction of the telephone and electric traction. He is convinced that every consideration will be given to the British in these matters, for England never occupied so high a position in the estimation of the Turks as she does to-day. While the new Government are perfectly aware of the great advantages of adopting modern methods, they are hampered by the want of money in the national exchequer, and, though they would like to exploit these services themselves, they will probably be forced to give them out in the form of concessions."

Aluminium Solder.—A new flux and solder for aluminium has been invented by Mr. Otto Nicolai, of Boppard on the Rhine, Germany; the inventor states that after scraping the parts of aluminium to be joined and applying the flux, a firm joint can be made with the solder, which flows readily into the crevices. Sheets soldered together can be hammered thin, and tubes with a soldered seam can be bent or forced on to a drift without injuring the joint. A sample joint sent to us appears to be extremely strong.

Annual Dinner.—The staff of Messrs. Crompton and Co.'s Chelmsford Works had their annual dinner on the 6th inst. in the club room, Mr. A. J. Hodgson, works manager, presiding, with Messrs. Claud Crompton and J. C. Macfarlane occupying the vice-chairs. Mr. W. G. Bickmore proposed the toast of "Messrs. Crompton & Co.," and mentioned that the firm had been in existence a quarter of a century. It had deservedly won the position of being one of the most prominent electrical engineering firms in the world, and a great deal of the credit was due to the indomitable pluck and perseverance of Col. R. E. Crompton.—The chairman, in responding, referred to the interest the directors took in their workpeople at Chelmsford.—Mr. H. J. Fell gave the toast of "The Chairman and Vice-Chairmen," and Mr. T. F. Thompson proposed "The Foremen," for whom Messrs. E. Docherty and J. C. Cole replied.

Trade Announcements.—Messrs. Mountain and Gibson, Ltd., of Bury, Lancashire, have recently completed negotiations for acquiring the works and business of Messrs. Thornewill & Warham, Ltd., engineers, of Burton-on-Trent. By this arrangement, Messrs. Mountain & Gibson will have better facilities for meeting the demands of their increased business, which has developed very rapidly during the last four years, and for which the accommodation at their Bury works has now become inadequate. Further particulars will be forthcoming shortly; in the meantime, we understand that a new company is being formed to take over the combined businesses.

Messrs. Mawdsley's, Ltd., Zone Works, Dursley, Gloucester, inform us that they have appointed Messrs. Paterson & Service, 38, Bath Street, Glasgow, as their representatives for Scotland, and Messrs. The Robinson & Hands Electrical Co., Ltd., 54, Barwick Street, Birmingham, as their representatives for the Birmingham district.

The Midland Electric Manufacturing Co., Ltd., of Birmingham, have appointed as their sole London representatives Messrs. Hogan & Wardrop, Gloucester Mansions, Charing Cross Road, London, W.C.

Messrs. Gillespie & Beales, of Amberley House, Norfolk Street, Strand, W.C., have appointed Mr. James Turnbull, 3, New Street, Birmingham, as their representative in the Birmingham district.

Messrs. Frank Jordan & Co., Engineers, of 34, Fenchurch Street, E.C., have been appointed representatives for the London District for Messrs. André Citroen & Co., suppliers of machine-cut double helical gears.

Dissolutions and Liquidations. — Headland's Patent Electric Storage Co., Ltd.—This company is winding up voluntarily, with Mr. G. D. Price, of Finsbury House, Blomfield Street, E.C., as liquidator.

Automatic Electrical Advertising Syndicate, Ltd.—A meeting is to be held at 26, Victoria Street, S.W., to hear an account of the winding-up from the liquidator, Mr. W. A. Allerton.

Book Notices.—"The Engineer's Year-Book of Engineering Formulæ, Rules, Tables, Data and Memoranda." By H. R. Kempe, M.Inst.C.E. 1909. London: Crosby Lockwood & Son. Price 8s.

"Die atmosphärische Elektrizität." By H. Mache and E. v. Schweidler ("Die Wissenschaft," Heft 30). Brunswick: F. Vieweg and Sohn. Price M. 6.

LIGHTING and POWER NOTES.

Aberdeen.—Councillor Gray reported to the Corporation Electricity Committee on the proceedings at the Conference in Glasgow, regarding the North British Power Syndicate's proposals. The resolution adopted was that local authorities should approach the B. of T. for the purpose of getting an Act of Parliament passed preventing railway companies giving wayleaves over their systems to any company or authority for the supply of electricity within the bounds of local authorities. The Committee approved of the resolution, and recommended its adoption by the T.C.

Aldershot.—The U.D.C. has arrived at an agreement with the Gas and Water Company whereby the Bill of the latter will not be opposed. Under this the company agrees not to supply electricity to be consumed in the Council's area. The Farnborough U.D.C. also will not oppose the Bill.

Ashby.—The Urban Council has had under consideration the question of introducing electric lighting, and the matter has been referred to the Finance Committee.

Barton (Lancs.).—The B. of T. has informed the R.D.C. that it is prepared to consider a transfer of the Electric Lighting Order to the Lancashire Electric Power Co.

Bradford.—At the meeting of the City Council last week, the minutes relating to the purchase of two 3,000-kw. Curtis turbo-alternators were passed. An amendment to refer the matter back for one month was defeated by 35 votes to 25.

Brighton.—It has been decided to defer the proposed extension of boiler plant at Southwick generating station pending the receipt of a further report from the Council's consulting engineer, Mr. Arthur Wright.

Bromley (Kent).—The R.D.C. has decided to petition against the West Kent Electric Power Bill.

Canada.—When seen through English eyes, the methods of Canadian supply companies appear a trifle unconventional. The Montreal Electric Light Co., under a charter obtained some time ago, has apparently swooped down on the city with a few carloads of poles and started to erect a pole line from the suburbs into the town. This procedure is based apparently on a clause giving the company the right to erect at least one row of poles without the permission of the city, and this work is being carried out, as far as one can judge, without reference to the city authorities. The company claims that it can supply cheap power from a plant outside the city and in competition with the existing suppliers.

Cardiff.—The G.W.R. Co. has arranged with the Corporation to take energy at the rate of a quarter million units per annum at its yard and 200,000 units per annum at the station. The work of installation at Hill's dry dock is also completed, and the engines have been dismantled and motors substituted.

Continental Notes.—Spain.—A company called Saltos del Segre, has been formed in Barcelona for the purpose of utilising various waterfalls for generating electric power. In Valmaseda also, a new concern called Electra Encartada has recently been established which will undertake the generation of electric energy for lighting and power purposes.

Darlington.—The T.C. has been recommended by the Electricity and Light Railways Committee to install a 500-kw. generator driven by an exhaust-steam turbine.

Droylsden.—With reference to the electric light question, the U.D.C. has been informed by the Manchester Electricity Committee that a scheme is being prepared for the carrying out of the agreement with the U.D.C.

Dublin.—Arising from the report on the working of the electrical undertaking, which it is expected will result in a heavy deficit despite the increased consumption of electricity, the Electricity Committee is recommending an increase in the charge for private lighting of ½d. per unit, with a possible further increase, also that the decision to reduce the power rate from April 1st next should be reconsidered, and the possibility of arranging for a minimum power rate of 1½d. per unit taken into account.

Easthampstead.—After considering a communication on the subject from the B. of T., the R.D.C. has agreed to the revocation of the Camberley and District Electric Lighting Order, 1906, on the ground of the failure of the undertakers to exercise their powers within the specified time.

Fleetwood.—The U.D.C. will shortly take over the undertaking of the Fleetwood Electric Lighting and Power Syndicate, the necessary formalities having been arranged.

Glasgow.—The Water Sub-Committee, depending on the Council's approval, has given instructions for the issue to the Gas and Electricity Departments of amended water rates based on only one-fourth of the annual value of underground cables, &c., instead of the full value as heretofore. This is stated to be in accordance with Sec. 36 of the Glasgow Act of 1891, and the above departments have apparently been charged four times their rightful amount in the past.

Herne Bay.—The U.D.C. has received from Lacey, Sillar & Leigh a report on the proposed E.L. scheme. The estimated cost of the plant is £13,828; the annual working cost is placed at £1,716 per annum; and the gross annual revenue at £2,082. A profit of £366, after paying all charges, is estimated for the second year of operation.

Hornsey.—The Council has decided to lodge a petition against the North Metropolitan Electric Supply Bill, and is inviting the local authorities of Finchley and Walthamstow, which would also be affected by the Bill, to attend a conference with a view to arranging joint opposition. The Bill seeks power to extend what is called the "special district" in the company's Act of 1907, and the Committee pointed out that if the Bill was passed, it would enable the company to supply electricity for power to any person in Hornsey, and also for lighting to any person supplied with power if the B. of T. considered that the Council, as the authorised distributor in Hornsey, was unreasonably withholding its consent.

Hove.—The T.C. has sanctioned further experiments with electric street lighting in Aldrington, and for this purpose 35 gas lamps are to be converted at a cost of 1s. 10d. per post, the cost for energy and renewals being £2 3s. a year for each post in addition.

India.—The Indian mail to hand this week brings the news that the Railway Board has informed the secretary of the Indian Railway Conference Association that it notes the opinion that further experiments are necessary before any conclusion can be come to on the subject of the best system of electric lighting for trains. The Railway Board has decided that all additional first and second-class stock, as also renewals of existing carriages of these classes on State railways, shall be fitted with electric lights and fans on Stone's system. The Railway Board approves of the proposal made by the Association that a Standardisation Committee be promptly formed from locomotive and carriage superintendents, and electrical engineers as parties to the conference, to standardise certain details in all carriages lighted by electricity.

The Municipal Board of Lucknow is considering the question of the best mode of lighting the streets of that ancient city. Both gas and electricity have their advocates on the board.

London.—It is proposed to serve notices on the Battersea and Woolwich B.C.s and the London Electric Supply Corporation and Metropolitan Electric Supply Co., requiring them to provide suitable testing stations to enable the L.C.C. inspectors to check the supply pressure.

Bermondsey.—The B.C., after a lengthy discussion, has decided to apply to the L.C.C. for a loan of £3,000 for additional mains and services.

London.—Hammersmith.—In regard to the supply of electricity to the Exhibition grounds, the B.C. has made similar agreements with the Exhibition Committee and the Kensington and Notting Hill Electric Lighting Co. as last year. The only difference is that the company has consented to drop the condition imposed as to the Council guaranteeing to pay for a specified minimum number of units during the period covered by the agreement. Fifty-three lamps in three streets are to be converted from gas to electricity at an initial cost of £264.

Maidstone.—The L.G.B. has sanctioned a loan of £20,000 to defray excess expenditure, but stipulates that the proportions of principal that would have been payable if the loans had been obtained at the proper time, amounting to about £1,200, should now be paid out of revenue.

Maldens and Coombe.—The B. of T. has informed the U.D.C. that the County of London Electric Supply Co. intends to commence the works under the Electric Light Order, 1907, at an early date, with the view of having the supply available in the summer of this year.

Middlesbrough.—A L.G.B. inquiry was held on Friday, into the application of the T.C. for a loan of £3,210 for electric lighting purposes, £1,350 being for services and connections; £1,000 for mains extensions; £600 for meters; and £210 in respect of excess expenditure over loans during the past five years. There was no opposition.

North British Power Syndicate.—Last week we referred to the meeting of representatives of the various Scottish municipalities supplying electricity, which was held in Glasgow. The explanatory circular through which the meeting was convened pointed out that:—

"A syndicate has been formed under the name of the 'North British Electric Power Syndicate, Ltd.,' which proposes to erect a generating station or stations in the proximity of railway lines running through or adjacent to the area of authorised electricity undertakers, with the object of supplying without any Parliamentary powers, cheap electrical energy to collieries, railways, factories, mills, tramways, local authorities, &c., even where these are already, or might be, supplied by municipalities within their areas of supply. The syndicate believe that there is a demand for a cheap supply of electric current, and that the supply already provided by municipal authorities and by electric light companies, operating under statutory powers, is inadequate. It is the intention of the syndicate to utilise railway tracks for the laying of cables, and it is understood that they have already adjusted with the North British Railway Co. and the Caledonian Railway Co. the heads of an agree-

ment relative to wayleaves for cables. The syndicate have also approached consumers within the areas of various municipalities with the object of getting them to enter into an agreement to take their current from the syndicate. If the syndicate are allowed to start business, there is no doubt that its operations would be highly prejudicial to the electricity undertakings of municipalities. . . . Having regard to the statutory rights possessed by authorised undertakers, to the restrictions and penalties under which they are placed as to the method of giving a supply, and to the charges they may make, and other circumstances, it has been generally understood that, to a certain extent, an exclusive right had been conferred upon them for the supply of electric current within their own areas of supply, and that such exclusive right would be continued so long as such authorised undertakers reasonably met the needs of all the consumers within their areas. The syndicate, without getting Parliamentary powers, and submitting to the conditions imposed by Parliament on electricity undertakers, should not be entitled to compete with authorised undertakers in supplying electric energy. . . . It has been suggested that the proposed Conference might consider the propriety of (1) making representations to the Board of Trade with the view of getting a short Act of Parliament passed prohibiting any company or person, unless authorised by the Board of Trade under the Electric Lighting Acts or by Parliament, from distributing or supplying electrical energy for sale within the area of supply of any authorised undertakers; and (2) contesting the rights of the North British and Caledonian Railway Companies to make and implement the agreement as to wayleaves before referred to."

At the Conference the following resolutions were adopted, subject to the approval of the respective T.C.'s:—

"1. That this Conference of representatives from burghs and counties in Scotland, supplying or having the right to supply electricity in virtue of powers conferred upon them by Act of Parliament or by provisional order, resolves to represent to the Board of Trade that in the interests of the communities represented by them it is expedient that legislation be passed prohibiting any company or person, unless authorised by the Board of Trade, under the Electric Lighting Acts, or by Parliament, from distributing, transmitting, or supplying electrical energy for sale within the area of supply of any authorised undertakers.

"2. That this Conference remits to the town clerk of Glasgow to forward the representations referred to in the foregoing resolution to the Board of Trade, and further remits, with power, to the representatives of Aberdeen, Ayr, Dundee, Edinburgh, Falkirk, Glasgow, Govan, Greenock, Leith, Paisley, Partick, Perth, and Lanarkshire, by themselves or in co operation with representatives of other public bodies, to interview the President of the Board of Trade with regard to the matter, and to take united or other action as they may deem expedient to carry out the views of the Conference.

3. "That this Conference, in the event of its being found necessary to take action to test the validity of the agreement made between the North British Electric Power Syndicate, Ltd., and the railway companies, recommends town councils and county councils to bear a proportion of any expense which may be incurred in connection with such litigation—it being understood that before commencing litigation the matter will be submitted to another meeting of this conference."

Subsequently at a meeting of the Glasgow T.C. Committee, correspondence with the North British Electric Power Syndicate was submitted, and the matter was remitted to a sub-committee.

Perth.—Messrs. Anderson & Munro, electrical engineers, have fitted up an electrical installation for the engine shed and adjoining offices and stores of the Highland Railway Co. at Perth. The same firm fitted up the Highland Co.'s premises at Inverness with electric light.

Sunderland.—The T.C. has decided to petition against the County of Durham Electric Power Supply Bill.

Certain cables are to be relaid at a cost of £2,300.

Tayport (Dundee).—The T.C. is negotiating for the purchase of the gas undertaking from the gas company, and there is a feeling that should it fail electricity should be introduced.

Victoria (Aus.).—In connection with the destructor plant of the city of Prahran, a contract has been placed for generating plant to utilise the waste steam. It is estimated that 300,000 units will be generated, and an arrangement has been made with the Melbourne Electric Supply Co. to purchase the output at ¼d. per unit.

Wellingborough.—The Technical Committee has decided to have the machinery in the technical students' boot factory driven by electric motors.

Whitehaven.—The T.C. has received from the L.G.B. sanction to a loan of £787 for mains, services, battery booster and switchboard, public lighting, &c. A sum of £266 applied for has been disallowed in respect of sundries taken from stock for public lighting, and a debt of £254 on boilers which have been superseded.

Wokingham.—The R.D.C. and the Easthampstead R.D.C. have affixed their seals to petitions against the Gas and Electricity Bill to be promoted in Parliament by the York Town and Blackwater Gas Co., and at a recent extraordinary meeting of the Camberley Ratepayers' Association, a resolution was passed approving of the action of the Frimley U.D.C. in opposing this Bill, and also that of the Aldershot District Gas and Water Co.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the weekly meeting of the Electrical and Tramways Committee, a deputation waited to urge upon the Committee the desirability of coming to some agreement speedily with the Cavehill and Whitewell Tramway Co., as they were greatly inconvenienced, owing to the want of a connection. Subsequently, a recommendation to the Council to enter into a working arrangement with the company for one year on the draft basis already submitted, was defeated, and an amendment to take senior counsel's opinion on several points raised, was passed.

Cardiff.—The Corporation, on the recommendation of its officials, has decided to spend £11,000 in repairing the tramway tracks. Mr. Ellis stated that they were at present spending £7,000 a year on repairs to track, but if the £11,000 was spent he believed this sum would be reduced to £2,000 or £3,000 per annum. Mr. Harpur, the City engineer, said that Glasgow, Aberdeen, Newcastle, Sheffield, Liverpool, Birmingham, Newport and other places had adopted the method proposed with success. The system briefly was one of inserting anchors and joint plates. He had been using anchors in places in Cardiff for the last 12 months, and where they had been put down they had proved highly beneficial.

Continental Notes.—TURKEY.—From a Continental paper we gather that the application for electric tramway concessions in Turkey, already mentioned in these columns, emanated from Sir Clifton Robinson, on behalf of a London syndicate.

ROUMANIA.—With reference to the projected tramway construction in Bucharest, the Mayor and the Chief of the Municipal Technical Staff are actively engaged in the study of the project in question. A new line is proposed to run from the Northern Railway Station, roughly east and west. Another line would probably connect with the southern part of the city. A central electric power station would be built, and it is suggested that it could supply light in the streets through which the lines would run. The Mayor is said to be endeavouring to form a company to work the lines, and to this company the municipality may contribute one-third of the necessary capital. A Bill authorising a municipal loan in connection with the enterprise is to be presented to Parliament during the present session.—*Board of Trade Journal.*

Dundee.—At a meeting of the Tramway Committee, a sub-committee recommended that the trackless trolley system be installed in High Street to Craig Pier, and out to Ninewells, a distance of 2 miles 1,580 yards. It estimated the cost of overhead construction at approximately £2,700. Feeder cables would take another £500, while three cars would cost £2,000; a total of £5,200. If larch poles were used a deduction of £1,200 would be made, and the sub-committee recommended approval of the scheme, the total cost not to exceed £4,000. After discussion the whole matter was delayed until a report was forthcoming on an alternative route.

Kirkcaldy.—By a large majority the T.C. has agreed to extend the tramway system to Dysart. An alternative scheme proposed was to run the tramways to the west end of the town, and make a circular route. The Dysart extension was supported in a report by Mr. O. F. Francis, the electrical engineer, on the ground that the cost would be comparatively small. Provost Munro Ferguson, M.P., backed up the extension on the ground that it would provide employment and also promote unity between the two burghs. Opponents to the scheme wanted delay until the existing cars were paying better.

Liverpool—Southport.—A memorial, bearing over 300 signatures of season ticket-holders and ordinary passengers on the Liverpool—Southport electric section of the Lancashire and Yorkshire Railway, is to be forwarded to the B. of T., calling the department's attention to the construction of the carriages and means of ingress and egress in case of fire, &c., and requesting the Board to hold an inquiry.

A small fire, which occurred on one of the L. & Y. Railway Co.'s electric trains on Saturday last, occasioned considerable alarm amongst the passengers. The fire is supposed to have been due to a short-circuit, and it was extinguished by the staff.

London.—The proposed Imperial International Exhibition at Shepherd's Bush is to be provided with a 3 ft. 6 in. gauge tramway for the purpose of making every part of the grounds easily accessible. The cars are to be 30 ft. long × 6 ft. wide, and will provide accommodation for 30 passengers.

Lowestoft.—The engineer has been directed to report as to the cost of doubling the tramway track, and also the cost of carrying out the doubling in sections. It has been decided to reduce the price of energy used for tramway purposes to a flat rate of 2d. per unit; tenders are to be obtained for a new 250-KW. combined generating set.

Morecambe.—At the meeting of the T.C. on Monday, the town clerk reported the result of the arbitration award in connection with the purchase of the tramway undertaking from the Morecambe Tramway Co. The arbitrator (Major Cardew), as previously announced, awarded £13,391, which the town clerk pointed out was £4,026 less than was originally claimed, and £3,803 more than the amount originally offered by the Corporation. As the Council was not likely to secure its provisional order before July, it decided to ask the tramway company to run the cars until that date.

P

New Zealand.—The negotiations between the Launceston T.C. and Messrs. J. G. White & Co., in regard to installing a tramway system in the city have apparently come to a successful conclusion. The Corporation is to provide power for the tramways from its own plant at ½d. per unit.

South Shields.—Progress continues to be made in regard to the negotiations for the Tyne tube, and the matter has been considered by both the Corporations—Tynemouth and South Shields. At a meeting of the South Shields T.C. on the 10th inst., it was decided to petition against the Bill, but this is in regard to a question of detail. On the 11th inst. there was a joint meeting of the Parliamentary Committee of the two Corporations, who met to consider principally the financial aspect of the matter, especially the proposal for the Corporations to render themselves liable for the debenture interest. Mr. Schenk, the promoter of the Bill, interviewed the Committees, and he was told that the Committees did not see their way to guarantee anything, or to incur any financial responsibility until the railway was completed and certified by the B. of T. to be in working condition. Our correspondent understands that Mr. Schenk was willing to agree to the Corporation withholding financial responsibility until the scheme was completed.

Taunton.—The B.E.T. Co. has presented the plans of the proposed tramway extension to Rowbarton to the T.C. The line now stops at the railway station, and is just over a mile in extent, and the proposed extension will be nearly half a mile, passing through the most thickly populated part of the borough. The B. of T. has passed the plans, but owing to there being a double line beneath a railway bridge in the narrowest part of the route, the Council referred the plans back, and the matter is now at a standstill.

U.S.A.—The Rapid Transit Co. is installing a 5,000-KW. vertical Curtis exhaust-steam turbo-generator to work in conjunction with an existing 5,000-KW. compound engine and generator. The turbine generator is to be of the three-phase induction type electrically coupled direct to the engine generator and the turbine set will be controlled as to speed by the latter. It is expected that this plant will be working in April.

Wallasey.—A petition has been lodged in the House of Commons by the Wirral Railway Co., praying to be heard against the Wallasey Tramways Bill.

TELEGRAPH and TELEPHONE NOTES.

Afghanistan.—A telephone line from the Indian frontier at Jellalabad to Herat, in close proximity to the Persian border, is now almost completed. Its commercial and strategic value is very great, and the Indian Government is assisting the Amir in its construction.

Brazil.—The Presidential decree granting the cable concession to the Deutsch Sudamerikanische Telegraphen Gesellschaft is dated October 27th, 1908, and contains the usual conditions. A cable is to be laid from either Pernambuco, or Maceio, to Teneriffe, and in connection with the South American Cable Co. thence to the West Coast of Africa. The company is to pay the Brazilian Government 10 centimes per word on all its business sent or received, and has to deposit 50 contos of Reis (about £3,000) with the Government as a guarantee. The company undertakes to reduce the rate on messages between Brazil and Europe by 60 centimes.

China.—Writing from Kobe, Mr. Snodgrass informs the *Telegraph*, U.S.A., that an agreement has been arrived at between China and Japan in relation to telegraphs. The submarine cable between Kwantung and Chefoo is to be owned jointly, Japan owning the cable to within 7½ miles of Chefoo and China owning the remainder; China is to construct a telegraph line from the landing of the cable to the Japanese Post Office at Chefoo, which shall deal with messages in Japanese kana characters for the convenience of Japanese. China is to purchase the telegraph lines constructed by Japan in Manchuria during the Russo-Japanese war, but notwithstanding such purchase, the lines are to be worked by a Japanese staff for the convenience of Japanese residents in Manchuria.

Contracts by Telephone.—A decision was recently given, in the City of London Court, as to the binding effect of contracts made on the telephone. Judge Rentoul said that every contract made in that way ought to be confirmed by writing; if it were merely proved that a message had proceeded from a man's telephone in his office without any proof of who sent the message, he did not think it could be held that the firm was bound by any such statements.

Spain.—The telegraph system during 1906 comprised 35,141 km. of line and 75,524 km. of wire, these figures showing an increase over the previous year of 835 and 1,311 respectively; submarine lines accounted for 3,290 km. During the year there were 5,087 interruptions. Inland traffic decreased by 164,330 telegrams to 3,708,664 as compared with 1905. The international traffic consisted of 628,634 telegrams sent, 689,574 received, and 143,737 in transit, making a total of 1,461,945, or an increase of 91,671 over 1905. The total number of all kinds of telegrams handled by Spain was, therefore, 5,170,609. The receipts for inland messages were less than those of the previous year by 266,068 pesetas, totalling 5,506,124 pesetas, while receipts on account of international telegrams amounted to 2,008,581 fr., an increase over 1905 of 220,770 fr. Dealing jointly with the telegraph and telephone service, the total receipts were 8,943,815 pesetas, while the expenses were estimated in the Budget at 9,115,941 pesetas. As regards telephones, 64 systems were worked by private undertakings having 17,540 subscribers and producing a revenue of 3,681,387 pesetas. The Government systems numbered 11.—*Journal Télégraphique.*

Telegraphic Interruptions:—

Port Arthur-Chifu	March 9, 1904
Pontianak-Saigon	Sept. 16, 1908
Malta-Zante	Dec. 29, 1908
Tourane-Amoy...	Jan. 19, 1909

CONTRACTS OPEN and CLOSED.

OPEN.

Abertillery.—February 26th. Two 66-KW. vertical gas engines and dynamos, suction gas plant, balancer, booster, pipework, switchboard, poles and overhead conductors, cables, feeder and other pillars, and public lighting apparatus, for the U.D.C. See "Official Notices" February 12th.

Ashton-under-Lyne.—March 3rd. Water-tube boiler and engine-driven induced draught fan for the Electricity Department. See "Official Notices" February 12th.

Australia.—MELBOURNE.—Two multiple magneto switchboards for the incoming junction lines to the P.M.G.'s department in N.S.W. See "Official Notices" to-day.

Belfast.—March 8th. Tramway stores for the Corporation. See "Official Notices" to-day.

Bolton.—March 1st. Stores for the Tramways Department. See "Official Notices" February 12th.

Brighouse.—March 2nd. Balancing set, feeder cables, switchboard, &c., for the Corporation. See "Official Notices" February 12th.

Canada.—March 1st. Boilers, economiser, feed pump, mechanical draught, pipework, steam turbo-generator, steam engine generator, re-erection of steam engine, condensing plant, crane, switchboards, motor-generators and transformers, buildings, steelwork, &c., for the City of Lethbridge, Alberta. Tenders to the City Hall, Lethbridge. 10 per cent. of tender amount as deposit. Plans and specifications from Smith, Kerry & Chace, Confederation Life Building, Toronto, and the Carnegie Public Library Building, Winnipeg.

Cardiff.—February 19th. Two 300-KW. motor-alternators for the Corporation. See "Official Notices" February 5th.

Chelmsford.—February 19th. Maintenance and repair of the electrical fire alarm system for the T.C. W. Smith, Town Clerk, 16, London Road, Chelmsford.

Dublin.—February 25th. Arc lamp carbons for the Corporation electricity undertaking. See "Official Notices" to-day.

Dundee.—The Tramway Department invites tenders for stores. Mr. Peter Fisher, manager.

Edmonton.—February 24th. Electric light and power installation for the new infirmary. See "Official Notices" February 12th.

Elham.—March 11th. The lighting of the workhouse at Lyminge, near Folkestone. See "Official Notices" February 12th.

Esher.—March 3rd. Wiring for electric light at the sewage disposal works, Lower Green, for the U.D.C.; the surveyor.

Germany.—LISSBERG (HESSE).—The municipal authorities are about to invite tenders for the establishment of a central electric lighting station in the town at an estimated cost of £100,000.

Halifax.—February 23rd. Electric installation at new premises for the Halifax Equitable Pank and Building Society. Richard Horsfall & Son, Architects, 22A, Commercial Street, Halifax.

Hammersmith.—The B.C. is about to convert the lift at the Town Hall from hydraulic to electric power at a cost of £188. Tenders are to be obtained for the work. Borough Surveyor is preparing specification.

Heston and Isleworth.—March 3rd. Sundry cables and electrical supplies for the U.D.C. See "Official Notices" to-day.

Hornsey.—March 8th. Meters, cables, troughings, &c., for the T.C. See "Official Notices" February 12th.

Ilford.—February 23rd. Meters and other stores for the U.D.C. electricity works. See "Official Notices" February 5th.

Leeds.—February 25th. Stores for the Corporation Electrical Department. See "Official Notices" January 29th.

February 20th.—Coals and materials for the Tramways Committee. Mr. J. B. Hamilton, General Manager.

London.—Tenders are being invited for the supply of a complete plant for the production of electrical cables of every description. See an "Official Notice" in this issue.

Battersea.—March 2nd. Materials for the B.C. Electricity Department. See "Official Notices" February 12th.

L.C.C.—February 24th. Electric lighting, bells and fans at the Trade School for Girls, Queen's Square, Bloomsbury. See "Official Notices" February 12th.

L.C.C.—March 9th. Two 1,500-kw. rotary converters and six 575-kw. single-phase transformers for the Elephant and Castle tramways sub-station; switchgear; electric light wiring for Norwood tramways car-shed. See "Official Notices" February 12th.

Stepney.—February 25th. Condenser pipework (partly subaqueous) settling tanks, valve chamber, and river wall at Blyth's Wharf for the extension scheme. Borough engineer, Mr. M. W. Jameson. Deposit £5 Bank of England note.

Fulham.—March 3rd. General and electrical stores for the B.C. See "Official Notices" to-day.

Westminster.—February 26th. Combined high and low-tension switchboards; low-tension D.C. switchboard and battery boosters for the Westminster Electric Supply Corporation, Ltd., at Horseferry Road station. See "Official Notices" February 12th.

Newport (Mon.).—February 23rd. Three four-wheeled double-deck tramcars for the Electricity and Tramways Committee. See "Official Notices" February 5th.

March 2nd.—Electric light fittings for the Board of Guardians. Ithel Thomas, Clerk, Queen's Hill, Newport (Mon.).

Radcliffe.—March 2nd. 300-kw. steam dynamo, 100-kw. motor-generator, booster, condensing plant, piping and switchboard extensions for the U.D.C. See "Official Notices" February 12th.

Roumania.—Ploessi.—March 3rd. The municipal authorities are inviting tenders for the concession for the construction and working of an electric tramway in the town during a period of 30 years.

Salford.—March 1st. Sinking a bore-hole and supply of pumping plant for the Electricity Committee. See "Official Notices" to-day.

Stockport.—March 1st. New distributing mains at Stepping Hill Hospital, for the Guardians. See "Official Notices" February 12th.

Wimbledon.—March 4th. Stores, &c., for the Corporation electricity department. See "Official Notices" February 12th.

Wrexham.—March 13th. Materials for the Corporation electrical department. See "Official Notices" to-day.

York.—February 24th. System of telephones and fire alarms for the B.G. Geo. Sykes, Clerk, 1, Museum Street, York.

CLOSED.

Bury.—The Electricity Committee has accepted the tender of Mr. Jacob Todd for oils, and that of Mr. C. McFarlane for composition.

Chester.—The T.C. has accepted the following tenders:

McLellan Bros., Chester.—Extension of the electricity works.
Tudor Accumulator Co.—Battery.
Lancashire Dynamo & Motor Co.—Automatic booster.
B. Thomas.—Switchboard.

Buxton.—The U.D.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for chain-grate stokers for the electricity works, at £680.

Dundee.—Messrs. Steinthal & Boydell, Ltd., have secured the contract for the wiring for electric light and other work in the new physics laboratory at University College, at £338.

Edmonton.—The B. of G. has received the following tenders for the supply of electric lifts:—

Easton Lift Co.	£1,550
A. Smith & Stevens	1,547
Waygood & Co.	1,468
Lift & Hoist Co.	1,416
Medway's Safety Lift Co.	1,295
J. G. Childs & Co.	736

Harrogate.—We are informed that the contract for wiring the four Council Schools here with 452 lights has been given to Mr. Thomas Wray, of Harrogate, not as announced last week.

London.—L.C.C.—Cross-over at Rye Lane, Peckham, with insulator boxes and covers:—Hadfield's Steel Foundry Co. Ltd. (£350) (accepted).

Private telephone service instruments at several car-sheds:—W. T. Henley's Telegraph Works Co. (in extension of their existing cable contract), £160.

Messrs. Tangyes, Ltd., are to be allowed to sub-let to Messrs. Heenan & Froude, Ltd., the supply of a water dynamometer, and to Messrs. Sterne & Co., Ltd., of a double-head grinding machine, under the contract for supplying electrical shop machinery to the central car repair depôt.

Woolwich.—An order has been placed with the General Electric Co., Ltd., for 1,000 Osram lamps of various kinds, to be delivered in quantities as required during the next 12 months.

The Great Northern and City Railway Co. have placed a contract with Siemens Bros. Dynamo Works, Ltd., for tantalum traction lamps.

Hammersmith.—The B.C. has received the following tenders for machinery, &c., required for the Exhibition supply:—

Two 400-kw. Transformers to Transform 2,300 Volts to Three-Phase 5,000 Volts.

	Per set.
Siemens Bros. Dynamo Works	£247
" " "	310
Brush Electrical Co.	268
British Electrical Transformer Co. (prov. accepted)	278
" " "	298
" " "	306
" " "	378
Johnson & Phillips	280
British Thomson-Houston Co.	305
British Westinghouse Manufacturing Co.	330
Ferranti, Ltd.	363

Two 250-kw. Single-Phase Transformers.

	Oil cooled. Each.	Air cooled. Each.
Brush Electrical Engineering Co.	£135 and £170	..
British Thomson-Houston Co.	146	£188
Johnson & Phillips	150	..
British Electric Transformer Co. (accepted)	153	184
British Westinghouse Co.	172	..
Ferranti, Ltd.	180	..

4,400 Yards Extra-High-Tension Cable and 60 Joint Boxes.

	25 cables and boxes.	3 cables and boxes.
Western Electric Co. (provisionally accepted for both items)	£1,680	£1,963
Johnson & Phillips	1,733	2,009
Callender's Cable Co.	1,757	2,022
Anchor Cable Co.	1,767	2,043
Henley's Telegraph Works Co.	1,763	2,045
St. Helens Cable Co.	1,767	2,057
W. T. Glover & Co.	1,770	2,044
Siemens Bros. Dynamo Works	1,773	2,063
British Insulated & Helsby Cables, Ltd.	1,800	2,035
Lahmeyer Electrical Co.	1,863	2,162

The offer of the British Electric Transformer Co., Ltd., to install four three-phase transformers on hire for one year for a sum of £135 has been accepted.

Tenders have been submitted by 16 firms for the 2,000-kw. turbo-alternator. The Electricity and Lighting Committee reported at Wednesday's meeting that they considered it desirable, before making any recommendation thereon, to make further inquiry into the details of the construction of certain of the machines offered. They propose that a special meeting of the Council be convened for Wednesday, 24th inst., to consider their full report upon the tenders.

South Africa.—Cape Town.—Tenders have recently been called for by Mr. W. G. P. MacMuldrow on behalf of the Bank of Africa for the supply and erection of a bullion lift, an inclined plane hoist, sump pump and motor with automatic starting gear, forced draught ventilating fans, a power distributing switch and fuseboard, and the removal and refixing of printing machinery, motor, ventilating fans, &c., in connection with the Bank's new premises in St. George's Street. Separate tenders were asked for each item, but on the recommendation of Mr. MacMuldrow, the Bank accepted the tenders of the Clyde Engineering Works for the whole of the work. It is understood that the successful tenderers were able to offer special facilities in the shape of quick delivery and erection, the greater portion of the required machinery being either in stock or such as they could make locally.

INQUIRY COLUMN.

[Replies under cover to us should be accompanied by stamped envelopes ready for retransmission to our correspondents.]

Correspondents ask for the names of manufacturers or suppliers of the following items:—

"Voss Electric Flashers" and "Kama Electric Protecting Lamps."

"Arcanon" Arc Lamp.

Portable apparatus for Testing Circuit-Breakers in position on tramcars.

"Helmet" light for hospital theatres.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERAVON.—Rebuilding Jersey Beach Hotel; F. B. Smith, architect, Port Talbot. Parsonage house, Pentyla, for the Vicar of Aberavon.

ABERDEEN.—Extension of calendering department at Broadford Works. Offices for the Boys' Brigade; G. Mitchell, architect, 48, Union Street, Aberdeen.

ABERDEENSHIRE.—New barn and engine house at Ladywell Farm (Drumrossie Estate). Davidson & Garden, 12, Dee Street, Aberdeen.

ALTRINCHAM.—Extension of Hale Road Wesleyan Sunday Schools.

AUGHTON (near SHEFFIELD).—New schools at Aston-with-Aughton. F. A. Darwin, Clerk of the C.C., County Hall, Wakefield.

AVOCH, N.B.—Additions to school (£1,800). J. McDonald, architect, Fortrose, N.B.

BALLINAMORE (IRELAND).—New R.C. hall to be built.

BARNOLDSWICK.—Weaving shed (1,300 looms), for the Barnoldswick Room and Power Co.; P. Pickup, architect, Mercantile Chambers, St. James' Street, Burnley. Extension of weaving shed, for the Bankfield Shed Co., Ltd.

BARNSLEY.—Proposed pavilion in the Park, for the T.C. (£600).

BARNSTAPLE.—Enlargement of Rothwell School, for Mrs. Coulthard; J. Cater, builder. Dynamo and lighting installation at builder's works, for J. Cater, builder, Victoria Road; electric light to be installed in house in Victoria Street, for J. Cater, builder.

BARRY.—Works for the manufacture of patent fuel.

BARTON (MANCHESTER).—Extensions for Taylor Bros., engineers, Trafford Park, Manchester. Proposed workhouse extension at Patricroft; Mr. Whitworth, clerk, Barton Board of Guardians.

BATLEY.—New St. Andrew's Church, Purlwell. Hoare & Wheeler, architects, 11A, Orchard Street, W.

BEARSDEN (GLASGOW).—Rebuilding parish church (£5,000). H. Higgins, architect, 248, West George Street, Glasgow.

BEDFORD.—Bunyan Memorial Church at Elstow. Rev. W. C. Piggott, Bedford.

BELFAST. Two semi-detached villas, Trenthill Park; two in Falls Road. Young & Mackenzie, architects, 17, Donegal Square, Belfast.

BERWICK-ON-TWEED.—Additions to Main Street Schools, Spittal, for the T.C. Gray & Boyd, architects, 2, Ivy Place, Berwick.

BLACKBURN.—Additions to works. Wm. Kay & Sons.

BLAINA (MON.).—Enlarging and extending Council School. R. L. Roberts, architect, Abercarn.

BOLTON.—Proposed White City, Doffcockers Estate, to be electrically equipped. Mission room, Weil Street (£1,800); D. F. Green, architect; Bolton Stone Co., builders.

BOURNEMOUTH New branch library at Boscombe. C. Riddle, borough librarian, Central Library, Bournemouth; (architect not yet appointed).

BRADING (ISLE OF WIGHT).—New school for the C.C. (£3,000).

BRANSFORD (near WORCESTER).—New station for the Great Western Railway Co.

BRENTWOOD.—Improvements, &c., at the Town Hall (£1,000).

BRISTOL.—New lighting scheme at High Littleton Wesleyan Chapel. Alterations and improvements at the Royal Infirmary; P. Adams, architect, 65, Leadenhall Street, E.C. Alterations to premises, 7, Unity Street, College Green (£950); Ware, Hillyer & Co. House, Ham Green (£450); David Walker. Skating rink at Clifton, for Crawford & Wilkins, American Roller Rink Co.

BUCKINGHAMSHIRE.—Extension of schools at Tylers Green (£1,000), and Wheeler End (£500), for the C.C.

BURSLEM.—New mill for the Burslem Mills Co., Ltd. A. R. Wood & Son, architects, Tunstall.

BURY.—Additions to Fernhill Mill; T. Hardman & Sons.

BURY ST. EDMUNDS.—Proposed new hospital for consumptives. Town Council.

BUXTON.—Church; C. Swan, architect, College Road, Buxton.

CARDIFF (WHITCHURCH).—Farm buildings in connection with the Mental Hospital. J. Wheatley, town clerk, City Hall, Cardiff.

CASTLECARY (N.B.).—School; J. Martin, architect, Kilsyth, N.B.

CASTLEFORD.—Eighteen houses, Cutsyke. Mark Palmer, Cutsyke.

CASTLETON.—Proposed billiard hall. J. Booth & Sons, architects, Haslingden.

CHARD.—Row of villas. Washer Bros., builders.

CHATHAM.—Houses, 26, in Beaconsfield Road, for H. P. Hughes; premises, Luton Road, for C. E. Skinner, builder, Railway Street.

CHURWELL (near LEEDS).—Parsonage for All Saints' Church. Rev. J. C. Harding, curate-in-charge.

CLAYTON-LE-MOORS (near ACCRINGTON).—Six houses, Blackburn Road, for Thomas Livesey.

COCKFIELD.—School; F. Coates, county offices, Durham.

COATBRIDGE (N.B.).—Prospective rebuilding, after fire, of chemical works, for the Gas Residual Product Co., Glasgow.

COLNE (BARNOLDSWICK).—Proposed new St. James' Parish Church.

CONISBOROUGH (near ROTHERHAM).—Alma Inn to be rebuilt.

COTTINGHAM (near HULL).—Four pairs of villas, South Street, for H. Whiting.

COVENTRY.—Out patient department, Coventry and Warwickshire Hospital; H. W. Chattaway, architect, Trinity Churchyard, Coventry. Rebuilding factory, Lower Ford Street, for T. F. Jackson; alterations and additions, Hertford Street, for W. Higgins; hardening shop, Mile Lane, for Swift Motor Co., Ltd.; factory, White Friars Street, for D. Payne.

CREWE.—Workshops, Priest Street, for H. Beech; store rooms, Stalbridge Road, for W. H. Clews.

CROYDON.—Extensive alterations of business premises, 101, High Street, for the Croydon Furnishing Co.

CROMARTY (N.B.).—Additions to All Saints Church. Ross & Son, architects, Inverness.

CWM (MON.).—New Workmen's Institute. S. H. Hutchings, architect, Risca, Mon.

DARLINGTON.—Secondary School; W. Rushworth, architect, Shire Hall, Durham. Rebuilding Middleton St. George Schools, for the Council.

DARWEN.—Additions to Waterfield Mill; Davies & Co.

DENNY (STIRLINGSHIRE).—Proposed new police station. E. Simpson, architect, Stirling.

DENTON (NORTHANTS.).—New Baptist Church.

DONCASTER.—New school; Empsall & Clarkson, architects, 7, Exchange, Bradford. Rebuilding Forester's Arms, Adwick-le-Street, for Mr. Slater; H. Beck, architect, Doncaster.

DOUGLAS (ISLE OF MAN).—Remodelling of business premises, 57A, Duke Street, for T. H. Cowin, draper, Prospect Hill.

DUNDEE.—Home for dogs (£2,000); J. Thomson, city architect, Dundee. Proposed new central reading room for Corporation; J. Thomson, city architect. Semi-detached villas, for Jas. Nicoll, in Coupar Angus Road.

DUNFERMLINE.—Gymnasium (£5,000). H. D. Barclay, architect, 245, St. Vincent Street, Glasgow.

DURHAM.—Additions to Technical School (£5,000); Oliver, Leeson & Wood, architects, Milburn House, Newcastle-on-Tyne; J. White, builder, High Barnes Works. General Graham Street, Sunderland.

EAST FIFE.—Laundry premises for the East Fife Laundry Co. D. Hetherington, solicitor, Hunter Street, Kirkcaldy, N.B.

EDINBURGH.—Probable rebuilding, after fire, of Bonnington Church, Bonnington Brae. Police Station, McLeod Street; City Architect, Edinburgh. New works for the Simpson Label Co.; A. Horsfield, architect, 88, George Street, Edinburgh.

ELTHAM.—Four houses, Shooter's Hill Gardens, and six houses, Dumbreck Road, Eltham; J. J. Bassett, builder, 121, Earlshall Road, Eltham. Conversion of 112, High Street, into shop; Whistler & Worge, surveyors, 80, High Street, Eltham.

ENFIELD.—Schools at Lavender Road. G. E. T. Laurence, architect, 22, Buckingham Street, Adelphi, W.C.

FALKIRK.—Proposed Hippodrome. Robertson & Dobbie, architects, Glasgow.

FARNBOROUGH (HANTS.).—Additions to Albany Cottage for H.I.M. Empress Eugenie.

FARNWORTH (near BOLTON).—Proposed skating rink. Jas. Barnes, Morecambe.

FLEETWOOD.—Cottage hospital extension; B. Drummond, architect, 6, Birley Street, Blackpool.

FLIXTON.—Nine houses, Victoria Avenue, Albert Grove; A. Jackson.

FORFAR.—Baths (£6,000); H. J. Blanc, architect, Rutland Square, Edinburgh.

FRENSHAM (near FARNHAM, SURREY).—Proposed permanent church of England (£2,400).

GALASHIELS.—Refuse destructor (£15,000); W. Thomson, borough surveyor, Galashiels.

GLASGOW.—Six tenements of dwellings in Nairn Street and Esmond Street; Overnewton Building Co., Glasgow. Fifteen terraced houses, Crow Road, Jordan Hill; J. Philip, builder, 87, Union Street, Glasgow. Bowling Green Club House, Carmunnock Road, Mount Florida; Mount Florida Bowling Club, Ltd., Glasgow. Extension of works, Parkhead; Applebys Ltd., Crane Works, Rigby Street, Parkhead, Glasgow. Additions to 292, St. Vincent Street (£4,000); H. D. Barclay, 245, St. Vincent Street, Glasgow. Additions to factory, Cavendish Street, for C. J. Douglas; Burnet, Boston and Carruthers, 180, Hope Street, Glasgow. Engineering shops for Sir William Arrol, Ltd.

(QUEEN'S PARK).—Extension to works of North British Locomotive Co. (£50,000); Sir William Arrol, Ltd., Preston Street, Bridgeton, Glasgow. Additions to Notre Dame Roman Catholic College, Dowanhill (£1,000); Bruce & Hay, architects, 261, West George Street, Glasgow.

(BOTHWELL).—Council offices. Beattie & Morton, architects, 121, St. Vincent Street, Glasgow.

(STEVENSTON).—Extension of Railway Station, Glasgow and S.W. Railway. W. Melville, engineer, St. Enoch Station, Glasgow.

GOOLE.—Coal mining developments contemplated. Pease & Partners.

GORSE HILL (MANCHESTER).—Church (£4,000). E. Woodhouse, architect, 88 Mosley Street, Manchester.

GOSPORT.—Proposed new Soldiers' Institute. Proposed new hotel, Priory Road, Hardway, for Brickwood & Co., Ltd., Catherine Brewery, Portsmouth; H. A. F. Smith, architect, Star Chambers, Gosport.

GREENOCK.—Roman Catholic School, Patrick Street. W. R. Watson, architect, 95, Bath Street, Glasgow.

GUILDFORD.—Proposed Church Mission Hall at Stoke (£1,500). The Rector.

GUZEBO (Co. KILKENNY).—New R.C. Church. Rev. M. Power, parish priest.

HALIFAX.—Establishment of a Zoo, with places of amusement, Chevinedge, near Salterhebble. C. C. Lloyd, architect, Halifax.

HAMPTON (MIDDLESEX).—Bakehouse and store at Suffolk House. G. F. Sharpe, architect, 57, Chancery Lane, W.C.

HANLEY.—Alterations at the Police Offices, for the T.C.; public conveniences, Mines Bank and Crown Bank, for the T.C. (£1,550). Additions to Tontine Vaults, Tontine Street; R. Audley. Additions to premises, 60, Hammersley Street; W. Moiratt. Additions to Pottery School, Victoria Road; the Clerk, County Council Education Committee, Stafford.

HARPENDEN.—Additions to Fallows Green House, for Mrs. Dolphin-Smith.

HASLINGDEN.—Proposed conversion of farmhouse into a Boy's Home. Clerk, Board of Guardians, Haslingden.

HASTINGS.—Alterations and additions to 3, The Uplands, for the trustees of Mrs. Jackson; A. Wells, architect, Harold Place. Additions to laundry, 309, Harold Road, for A. E. King; A. Midmer, builder, 10, Clive Avenue.

HAWICK (N.B.).—Bath (£8,000). C. Brown, borough surveyor, Hawick.

HEANOR (DERBYSHIRE).—New Sunday schools in connection with the Derby Road Baptist Church.

HECKMONDWIKE.—Extensions to club premises, Back Lane. Henry Stead, architect, Heckmondwike.

HELENSBURGH.—Prospective rebuilding, after fire, of Tighcruachan, residence of Major McFarlane.

HERNE BAY.—Alterations, including smoking room, lounge and bath room, at the Dolphin Hotel; A. W. Saville, architect. Extension of the pier, &c., probably lit by electricity (£18,000), for the U.D.C.

HETTON-LE-HOLE (Co. DURHAM).—Public hall, Richard Street, for R. Barton.

HEYWOOD.—Alterations and extensions at Birch Mills. R. & J. Woods, Ltd.

HIGHER BROUGHTON (LANCS.).—Lecture hall. Dixon & Son, architects, Corporation Street, Manchester.

HULL.—New skating rink, for Crawford & Wilkins, American Roller Rink Co.

ILFRACOMBE.—General Post Office, for H.M. Office of Works.

INSCH.—Additions to school (£1,500). G. Sutherland, 26, Crown Street, Aberdeen.

INVERKEITHING (FIFE).—New Masonic Temple and Lodge rooms. Secretary of Lodge of Freemasons No. 60, Inverkeithing.

IRLAM (near MANCHESTER).—Houses and stables. Victoria Road, for Joseph Murray. Nine pairs of houses and refreshment and billiard rooms. Bradburn Road, for W. H. Taylor. Additions to house, off Liverpool Road, for Sir Bosdin T. Leech.

KIDDERMINSTER.—Workshop, Cookley, for the Chaddesley Corbett Manufacturing Co.

KILWINNING (AYRSHIRE).—New Town Hall.

KIRKWALL (N.B.).—Restoration of the Cathedral. G. M. Watson, architect, 60, Queen Street, Edinburgh.

LANCASTER.—Rebuilding Black Bull Hotel, Church Street, Lancaster, for W. Mitchell. S. Jackson, architect, Church Street, Lancaster.

LEICESTER.—New pavilion at the Wyggeston Boys' School. Head Master.

LINCOLN.—Extension of the Girls' High School (about £6,000), for the Governors.

LONDON (HAMMERSMITH, W.).—Buildings, corner of Wendell Road and Rylett Crescent, for W. Binfield; mains extension for power purposes to the works of the Compressed Air Carpet Cleaning Co., Glenthorne Road; mains extension for power purposes (7-H.P. motor) to the works of the Bush Engineering Co., Bulwer Road: mains extension for power purposes (10-H.P. motor) to the Old Oak Laundry, Bloemfontein Avenue; factory building in Hetley Road, Gale & Co.

(PUTNEY, S.W.).—Thirteen houses in Dungarvan Avenue, A. E. Pierce; six houses and shops in Lacy Road, E. J. Jones.

(HACKNEY, N.E.).—Buildings in Mare Street and Morning Lane, C. Winkley; Mission Hall in Tower Street, London Fields, T. Gates and Sons.

(BALHAM, S.W.).—Manual training centre at Fountain Road School.

(STREATHAM, S.W.).—Eight houses and shops in Streatham High Road and Guildersfield Road, A. R. Stowers.

(SOUTHFIELDS, S.W.).—Six houses, Wimbledon Park Road, and seven in Seymour Road, W. Wright.

(MARYLEBONE, W.).—Buildings on site of Nos. 33 and 34, Paddington Street, Hudson & Hunt.

(TOTTENHAM, N.).—Seven houses and two houses and shops, Dowsett Avenue; H. Foster, Hart Road, Harlow, Essex. Six houses and shops, High Road; C. D. Roberts, care of H. S. Couchman, 520, High Road, Tottenham. Twenty-three houses, Falmar Road, and lock-up shop, Clarence Road; G. W. Rowley, builder, 278, Philip Lane, N. Workshop, rear of 247, West Green Road; Brand, Pettit and Co, builders, 247, West Green Road, N. Addition to stores and offices, Seven Sisters Corner, and factory, Whitley Road; P. Hart, builder, 99, Maynard Road, Walthamstow, N.E. Electric sub-station, Phœnix Sawmills, Laurence Road; W. D. Tucker and Son.

(HIGHGATE, N.).—Alterations and additions, 20, Southwood Lane, for J. Southcott & Co., builders; 12 dwelling houses, Cholmeley Park, for Fedrick Bros., Highgate.

(KENSINGTON).—Workshops and stores (£2,000); electric light to be installed. Borough Engineer, Town Hall, High Street, Kensington, W.

(CAMBERWELL, S.E.).—Additions to 21, Calais Street, for J. B. Roux.

(HAMPSTEAD, N.W.).—Proposed flats at Haverstock Hill. J. Russell, 133, Haverstock Hill, N.W.

(LEE, S.E.).—Seven houses. A. G. Hastilow, 39, Scholars Road, Balham, S.W.

(BARNES, S.W.).—Ten houses, Blind Lane; Tyars & Jago, architects, 10, John Street, Adelphi, W.C. Conversion of houses into shops, and new bakehouse, Lower Richmond Road; O. H. Davis.

LOWESTOFT.—Alterations and additions to sanatorium. G. H. Hamby, borough surveyor, Lowestoft.

LYTHAM.—Three shops, Woodlands Road, for F. Wilson, builder; two shops, Woodlands Road, for W. E. Garlick, meat salesman, 46, Clifton Street.

MAIDSTONE.—Probable rebuilding, after fire, of cattle food factory, for Messrs. Mackey.

MANCHESTER.—Building scheme, for St. Philip's Church; Potts, Son and Hennings, architects, 34, Victoria Buildings, Victoria Street, Manchester. Mission church (£1,650); Potts, Son & Hennings, architects; Hollinworth & Sons, builders, Patricroft.

MARGATE.—Public shelters, for the T.C. (£2,000); Borough Surveyor. House, shop and bakery, Northdown Road, for Moodey and Chrisfield. Six houses, Richmond Avenue; S. E. Burrows, architect, 6, Cecil Street, Margate.

MATLOCK.—New buildings, Smart & Son; improvements at Council Offices; Surveyor.

MELTON MOWBRAY.—Royal Oak Inn, Pall Mall, to be rebuilt.

MERTON (SURREY).—Horticultural college (£200,000). Trustees of the late John Innes.

MIDDLEWICH.—Kinderton Arms to be rebuilt, for the North Cheshire Brewery Co., Macclesfield; Mr. Sheldon, architect.

MILNROW (LANCS.).—Twenty-six houses, Dale Street. Mr. Clegg, builder, Albert Mills, Milnrow.

MUSSELBURGH.—Proposed free library and recreation rooms for the T.C.

NAIRN.—Church (£3,000). J. Strang, Vicars Street, Falkirk, N.B.

NANTWICH.—Alterations and additions to Shavington-cum-Gresty Schools, for the C.C. H. Beswick, architect, Newgate Street, Chester.

NARBOROUGH AND WHETSTONE.—Air compressor station in connection with sewage works. J. Turner, engineer, Blaby Road, South Wigston.

NEWBIGGIN (NORTHUMBERLAND).—Alterations and additions to Police station. J. A. Bian, county architect, Moot Hall, Newcastle-on-Tyne.

NEWBURY (BERKS.).—Proposed conversion of Greenham House into first-class residential hotel. Jas. Buchanan, Petworth.

NEWCASTLE-ON-TYNE.—Premises, Northumberland Road. Stephen Fenwick & Co., builders.

NEW STEVENSTON.—Additions to school (£1,000). Bruce & Hay, architects, 261, West George Street, Glasgow.

NUNEATON (MARKET BOSWORTH).—Repairing the Stoke Golding Parish Church (£1,500).

OGMORE VALE (near BRIDGEND).—Church. J. C. Rees, architect, Parade Chambers, Neath.

OLDHAM.—New Wesleyan chapel. Trustees.

OSWALDTWISTLE.—Houses, 23 in Haworth Street, for W. Broad & Sons. Six in New Lane; Geo. Walsh & Sons, builders, John Street Saw Mills.

PAISLEY.—Rebuilding St. Columba's Church (£4,000). T. Abercrombie, architect, County Place, Paisley.

PELSALL (SOUTH STAFFS.).—New iron works near the railway station. E. Wilkes.

PERTH.—New premises in Atholl Street for W. Adie, baker; R. Hutton, architect. 184, Woodlands Road, Glasgow. Garage and offices at York Place for J. Marshall, architect, King Edward Street, Perth. New lodging-house; Rev. R. Oswald, Convener of Social Work Committee, Perth.

POLLOKSHAWS.—Proposed restoration of Town Buildings. Town Clerk.

PORTOBELLO (N.B.).—Main hall at the Marine Gardens, for Edinburgh Marine Gardens, Ltd. J. D. Gibson, surveyor, 60, Frederick Street, Edinburgh.

PORTSMOUTH.—Extensive alterations of premises, Norfolk Square, for Messrs. Marshall, drapers.

PRESTON.—Workshop at Longton; H. Howard. Alterations to business premises, 9, Fishergate, for J. Whitehead, ironmonger.

READING.—Wesleyan Church on Caversham Heights; Ravenscroft, Son and Morris, architects, The Forbury, Reading. Reconstruction of premises, for Heelas, Sons & Co., Ltd.; Davis & Son, builders, 121, Queen's Road, Reading.

RICHMOND-ON-THAMES.—Extensive alterations to shop premises, 20 and 21, King Street, for Walter C. Joel, furnisher.

ROBROYSTOWN.—Infectious diseases hospital (£3,000). A. B. McDonald, City Hall, Glasgow.

ROCHDALE.—Red Lion (licensed house), Lord Street, to be re-built. Thirty-four houses in the Spotland district, and on Hamer Hall Estate.

ROCHESTER.—Probable re-erection (after fire) of premises at Mockbeggar, Higham, for H. M. Cobb (damage, £3,000); motor store, Corporation Street, for Geo. Batchelor.

ROTHERHAM.—Proposed mission-church at Thurnscoe East; Rev. J. B. Beard, rector, Thurnscoe. Proposed new school at Dalton (420 children); county architect, County Hall, Wakefield.

RYE.—New Baptist Church (£2,400). P. Tree, architect, St. Leonards, Hastings; Ellis Bros., builders, Rye.

RYEDALE (DUMFRIES).—Factory (£4,000). Barbour & Bowie, architects, 58, Buccleuch Street, Dumfries.

ST. ALBANS.—Factory, London Road, for Viscount Grimston. Primitive Methodist schools, Barnard's Heath. Church (£7,824); J. Bentley and Sons, builders, Waltham Abbey.

ST. HELENS.—Row of shops, with billiard hall, in Bridge Street; W. Ellis, architect, Hardshaw Street, St. Helens.

SALFORD.—Proposed new St John's Roman Catholic school; Secretary, Education Committee, Salford.

SALISBURY.—Office, stores, &c., for the T.C. (£694); Billett & Musselwhite, builders.

SAWLEY (DERBYSHIRE).—Improved sewerage scheme. J. W. Newbold, clerk to the Sawley R.D.C.

SCARBOROUGH.—New music hall on site of Salisbury Hotel and adjoining premises in Huntriss Row; alterations to the Crown Hotel, Esplanade (£8 000).

SEATON.—Alterations and additions to Clarence Hotel. A. W. Yeomans, architect, Chard.

SEDGLEY.—Cookery, laundry and handicraft centres at Upper Gornal. G. Balfour, Director of Education, County Education Offices, Stafford.

SHEFFIELD.—Proposed new Baptist Church at Woodseats (£1,500).

SHIPLEY.—New Wesleyan Sunday Schools at Baildon (£3,000).

SOUTH BANK (YORKS.).—Rebuilding Anchor Inn, Cleveland Street, for Warwick & Co., Borobridge.

SOUTH SHIELDS.—Extensive additions to shipyards, for Readhead and Co., Ltd.

STAINLAND (YORKS.).—New spinning mill for Messrs. Holroyd.

STOCKPORT.—Moss Rose Inn, Heaton Norris, to be rebuilt. P. Peirce, architect, 80, St. Petersgate, Stockport.

STOKE-ON-TRENT.—Church Hall at Port Hill. A. R. Wood, architect, Burslem.

STRATFORD-ON-AVON.—Public conveniences for the T.C. J. Cox, builder.

STREET.—Higher Grade School; J. Pursey, surveyor. New offices, Lockhill factory

SUTTON (SOUTHEND).—Schools (£1,918). F. Whitmore, architect, 78, Duke Street, Chelmsford. S. Norden, builder, Rochford.

SWANSEA.—New block of offices in York Street, for Messrs. T. T. Pascoe; Musgrave & Peacock, architects, Metal Exchange, Swansea. Baptist chapel, schools and class-rooms, at Manselton; W. B. Rees, architect 3, Dumfries Place, Cardiff. Improvements at premises, Gloucester Place, for J. C. Higman, Eaton Grove (£1,500).

TADCASTER.—Additions to brewery for J. Smith's Tadcaster Brewery Co.

TAUNTON.—Additions to Sussex Lodge, for Dr. Winckworth; H. J. Spiller, builder. Three houses and one shop in Eastleigh Road; W. Smart, builder. New offices, &c., in Station Road, for H. J. Spiller, builder and contractor.

TEDDINGTON.—Houses, Bushey Park Gardens, for Stokes & Sons; King Edward's Grove, for A. Bell. Shop, Kingston Road, for W. G. Collier.

THORNABY-ON-TEES.—Roller skating rink, Robert Street, for Chas. Bedworth, Stockton.

TORQUAY.—Proposed music hall (site secured).

TREORKY.—Eight or more houses on Pencelli Estate. W. D. Morgan, architect, 194, Ystrad Road, Pentre, Rhondda.

TRIMDON GRANGE (Co DURHAM).—School. W. Bushworth, architect, Shire Hall, Durham.

TURRIFF.—Extensions to shops, for Davidson & McKenzie, High Street, Turriff.

ULLESPOOL.—Church. A. Maitland & Sons, architects, Academy Street, Tain, N.B.

WALKDEN.—Last week's advice re houses should have read Joseph Bridge, builder, Walkden, not James Ridge.

WALTON-ON-THE-HILL.—New Congregational Church (£1,000). H. Witton, Walton-on-the-Hill Congregational Mission Church.

WEDNESBURY.—New Sunday schools in connection with the Trinity Congregational Church.

WELLINGBOROUGH.—Five shops, &c., Market Street and Midland Road, for the British Electric Traction Co, Ltd.

WELLINGTON (SALOP).—Swimming baths (£5,000); G. Riley, borough surveyor. Proposed new Y.M.C.A. premises.

WEMYSS BAY.—Additions to hotel. A. Stevenson, architect, Cathcart Street, Ayr.

WESTGATE ON-SEA.—Proposed Town Hall, for the Parochial Committee; public conveniences, for the R.D.C. G. L. Butterworth, R.D.C. Surveyor, Birchington.

WESTON-SUPER-MARE.—Alterations and additions to T.C. offices. C. Addicott & Sons, builders.

WHITEHAVEN.—Proposed new school for the T.C. (£9,800).

WIDNES.—Proposed new works for the manufacture of sulphate of ammonia, Earl Street.

WIGAN.—New theatre (People's Palace and Opera House) for Wm. Benson, managing director of the Grand Theatre and Hippodrome, Leigh.

WINGATE (DURHAM).—Probable developments at Wingate Grange Colliery, for Sir Christopher Furness.

WOKING.—Proposed parish church in Batt's Corner.

WOLVERHAMPTON.—Swimming baths (£6,000). B. Green, borough surveyor. County school (£20,000); F. Fleeman, architect, Midland Bank Chambers, Wolverhampton.

WOMBWELL (near BARNSLEY).—New schools for the West Riding Education Committee. F. A. Darwen, clerk of the C.C., County Hall, Wakefield.

WOODHALL SPA (LINCS.).—Alterations to the Victoria Hotel; alterations and additions to the Spa Co.'s baths; alterations and additions to Scathon House Villa, Victoria Avenue, for Dr. Gwyn.

WORKSOP.—Alterations to premises, Potter Street, for Hindley Bros.; stables and carriage house, Sherwood Road, for G. Wright; Salvation Army Hall, Newcastle Avenue.

YIEWSLEY.—Wesley Guild chapel (£3,600); W. H. Knowles, secretary.

YORK.—Adaptation of premises in High Ousegate for billiard hall, for A. Taylor; Burnley.

Treating Water Electrolytically.—According to the *Australian Mining and Engineering Review*, the steel pipes of the W.A. goldfields water supply scheme are subject to considerable corrosion, and a suggestion has been made to the Government for treating the water by electrolysis before it enters the pipes. The process is the result of experiments by Mr. Elliott Cumberland, who claims that he could remove all the chlorine, which causes the corrosion, at a very moderate expense.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Friday, February 19th.—At 7.30 p.m. Visit to the Battersea Polytechnic.

Saturday, February 20th.—At 7 p.m. At the St. Bride's Institute. Social. Dance.

Saturday, February 27th.—At 3 p.m. Visit to the L.C.C. Generating Station, Greenwich.

Institution of Mechanical Engineers.—Friday, February 19th. At 8 p.m. Annual general meeting.

Royal Institution.—Friday, February 19th.—At 9 p.m. Discourse on "Recent Advances in Means of Saving Life in Coal Mines" by Sir H. Cunynghame.

Institution of Civil Engineers.—Friday, February 19th.—At 8 p.m. Students' Lecture on "Standardisation in Engineering Practice," by Dr. W. C. Unwin.

Tuesday, February 23rd.—At 8 p.m. Further discussion on Mr. S. J. Reed's paper on "The Design of Marine Steam Turbines."

Friday, February 26th.—At 8 p.m. Students' Lecture on "Standardisation in Engineering Practice," by Dr. W. C. Unwin.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, February 19th. At 8 p.m. At the Glasgow Technical College. Paper on "Surface-Contact Electric Tramways," by Mr. R. D. Archibald.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 19th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-on-Tyne. Discussion on Mr. J. M. Allan's paper on "The Fatigue of Copper Pipes."

Junior Institution of Engineers.—Saturday, February 20th.—At 3 p.m. Visit to J. & E. Hall's Refrigerating Machinery and Automobile Works at Dartford.

Royal Society of Arts.—Monday, February 22nd. At 8 p.m. Cantor Lecture on "Modern Methods of Artificial Illumination," by Mr. L. Gaster. (Lecture II.)

Institution of Electrical Engineers (Manchester Section).—Tuesday, February 23rd. At 7.30 p.m. At the University, Manchester. Paper on "Load Equalisers," by Mr. J. S. Peck.

Friday, February 26th.—Annual dinner.

(Students' Section.)—Saturday, February 20th. Visit to the works of Messrs. Crossley Bros., Ltd., Openshaw.

Faraday House Old Students' Association.—Tuesday, February 23rd. At 7 p.m. At the Queen's Hotel, Leicester Square, W. Annual dinner.

Institution of Electrical Engineers (Leeds Section).—Wednesday, February 24th At 7.15 p.m. Meeting at the University, Leeds.

Institution of Electrical Engineers (London).—Thursday, February 25th. At 8 p.m. At the Institution of Civil Engineers. Adjourned discussion on paper on "The Use of Large Gas Engines for Generating Power," by Messrs. L. Andrews and R. Porter.

Northampton Institute Engineering Society.—Friday, February 26th. Paper on "Water Rheostats," by Mr. C. W. Goodram.

Monday, February 22nd.—Visit to the Royal Arsenal at Woolwich.

Physical Society.—Friday, February 26th. At 5 p.m. At the Finsbury Technical College. Paper on "The Self-Demagnetising Factor of Bar Magnets," by Prof. S. P. Thompson and Mr. E. W. Moss; exhibition of Optical properties of combinations of mica and selenite films in convergent polarised light, by Prof. S. P. Thompson; and exhibition of electrical and other apparatus, by Mr. C. R. Darling.

NOTES.

Arc Lamp Patent Revocation Appeal.—Just as we go to press we have received an intimation that the British Westinghouse Electric and Manufacturing Co., Ltd., are giving notice of appeal from the recent decision of the Comptroller-General revoking their Bremer-Westinghouse flame arc lamp patent.

The Electrical Contractors' Association (Inc.).—(Liverpool Branch).—The monthly meeting of this branch was held at 42, Castle Street, Liverpool, on February 10th. Mr. Sutton presided, and there were also present Messrs. J. O. Rhodes, S. A. McGleish, H. Hinson, W. M. Herd, C.P. L. Titherley, G. A. Smith, F. W. Smith, A. E. Chesters, G. W. Clarke, C. R. Whipple and G. J. Harford, hon. sec. The reports of the Northern Section and Central Board meetings, which were attended by the branch delegates, Messrs. Sutton and Harford, were read. Arising out of the Central Board report a lively discussion ensued with reference to the C.M.A. agreement, the amount of the purchases by the members of the E.C.A. from the cable-makers to December 31st, 1908, probably falling below the minimum amount arranged between the two associations to enable the E.C.A. to claim the special rebates. Although all returns were not yet received it was the unanimous opinion of all the members of the branch that, should the amount required not quite be reached, the C.M.A. would treat the matter in the right way; taking into consideration that purchases for the 16 months would most probably reach over £10 000 more than the corresponding period in 1906-7, in spite of the fact that there had been a great depression of trade during 1908. The officers of the branch trust that the members' hopes will be realised as the agreement has done good work since it has been in force, and it would be absolutely fatal to its future working if a large number of the members refused to renew their agreements with the members of the C.M.A.

Mr. Rhodes gave his report on the working of the Workmen's Registration Bureau. He said the number of men on the register had nearly doubled since the last monthly meeting; the registration committee had been obliged to meet several times during the month to deal with applications, and as full proof of the popularity and usefulness of the bureau, he stated that all the men on the register, with the exception of two, had been applied for and taken into employment by the members. There had been only two out of the applications received which the committee had been obliged to refuse. On the proposition of Mr. Titherley it was resolved to send a postcard to each member of the branch calling special attention to the fact that no workmen must be taken into employment unless his name was on the register, and that on taking a man into employment or discharging him notification must be sent immediately to the Registrar.

A letter was read from Mr. Shaw, hon. sec. of the Manchester Branch, asking for details of the Registration Bureau, and the Hon. Sec. was instructed to reply.

Owing to the increased membership and work of the branch, Mr. Whipple was appointed assistant hon. sec. to take charge of the literary and social section. Mr. Herd was elected a member of the Registration Committee to fill the vacancy caused by Mr. Whipple resigning.

After some discussion it was decided to dispense with the usual annual dinner, and to celebrate the successful year's working of the branch by having a smoking concert and supper. This function will be held on Thursday, March 4th at 7 o'clock at the St. George's Restaurant, Redcross Street, Liverpool. Tickets, 3s. each, can be obtained from Mr. Whipple, Cook Street (to whom all communications respecting the section should be sent), or from Mr. Harford, 47, Tithebarn Street, Liverpool.

Electric Cable-way of the Wetterhorn.—The process of bringing the summits of the Alps within the reach of the most lethargic tourists has been carried a stage further by the installation of a so-called "funicular" on the Wetterhorn. A cable-way conveys the hardy Alpinist over a difficult part of the ascent—substituting a vector for a scalar quantity, so to speak. The line is in duplicate, each track consisting of two carrying cables and two haulage cables; the latter are connected to two suspended cabins, which are thus balanced, one descending while the other ascends. The haulage cables pass round a grooved drum at the upper station, which is driven by an electric motor of 50 H.P., shunt-wound, and fed with D.C. at 800 volts. Each of the cabins weighs over 5 tons fully loaded, and seats eight passengers. The distance between the two stations is 425·3 m. vertically and 365 m. horizontally.

Electrical Football League.—A Council meeting will be held on Wednesday, February 24th, at 7 p.m., in the offices of the St. James' Electric Supply Co., Ltd., 19, Carnaby Street, W.

The following matches take place on Saturday next, 3.15 p.m.:—St. Pancras Electric *v.* St. James' Electric, at Swain's Lane, Highgate; Robertson's Lamps *v.* Metropolitan Electric at Gunnersbury Avenue, Ealing.

Where Wisdom Reigns.—Sometimes one comes across a municipal councillor who, by reason of the originality of his thought and his statesmanlike dealing, seems destined to take office in that wider sphere of politics which men call Parliament. There must be many such geniuses lost in local obscurity at the present time—how are they to be recognised? May we make a suggestion? They may win immortal fame by proposing to run their electricity works without an engineer—there are plenty of unemployed labourers available—see how great are the economies lying within our reach. What a large saving, too, if you have no chief to spend money on extensions! Why *have* we been blind so long? The idea of dispensing with the chief is not ours, we strongly repudiate any suggestion of plagiarism. It is the sole property of a worthy councillor of the ancient borough of Stafford, where, with the works of Siemens at their very doors, they really *ought* to know something about electrical matters. This sage asked in the Council meeting last week whether they could not dispense with the services of the electrician at the electricity works, as there did not seem much for him to do, and the expenses on salary, &c., were very high. Not all the Councillors of Stafford are so wise as this, for we observe that he to whom it fell to reply said that they could not do without their electrician. He even said that the works were of considerable importance, and necessitated the presence of a skilled electrician or they would be in a highly dangerous position! Taking all things into consideration, he thought that the costs were very reasonable for such an undertaking. Really this decision astonishes us, and we move the adjournment of the House in order that so serious a situation may be discussed to the full in all its bearings.

Institution and Lecture Notes.—Central Technical College (Old Students' Association).—The eleventh annual dinner of the Association will take place on Saturday, February 20th, at 7.30 p.m., at the Trocadero. Dr. Bovey, rector of the Imperial College, will be one of the chief guests.

Birmingham Association of Mechanical Engineers.—On February 6th, Mr. R. Bechtel read a paper upon the Nurnberg gas-engine, and stated that 247 Nurnberg double-acting high-pressure gas-engines of altogether 308,000 B.H.P. had been built or ordered during the last six years, a record which was unique.

South-Western Polytechnic Institute, Chelsea. — Prof. Henry A. Miers, D.Sc., F.R.S., Principal of the University of London, presents prizes and certificates to students of evening classes and day college on March 12th, at 8.0 o'clock p.m.

Illuminating Engineering Society.—We hear that an informal dinner was held at the Criterion Restaurant, Piccadilly, on February 9th, at which the formation of an Illuminating Engineering Society in this country was the subject of discussion, Mr. Leon Gaster presided over a gathering representing the engineering, architectural, medical, and other interested professions. Mr. Gaster briefly described the development and progress of the illuminating engineering movement in this country, and explained the objects of the proposed society, namely, to provide a free and impartial platform for the discussion of questions connected with illumination. He emphasised especially the fact that what he proposed was an "Illuminating Engineering Society" and not a society of "Illuminating Engineers." Anyone interested in furthering the science and art of illuminating engineering would be able to join the society; membership, however, would not entitle anyone to any professional status. In this respect the society would resemble similar and flourishing institutions already existing in this country. In the discussion that followed, it was generally felt that the time was ripe for starting such a society

Further particulars may be obtained from Mr. Gaster, at 32, Victoria Street, S.W.

On Tuesday, 9th inst., at a meeting of the Manchester Geological and Mining Society, Mr. Gerald J. Hooghwinkel read a paper, advocating the more general use of electricity in coal mines. He said the introduction of electricity in the coal-mining industry in Lancashire had not progressed so rapidly as in Yorkshire, South Wales and Durham, but improvements in that direction were now becoming manifest.

Liverpool and District Electrical Association.—A party of members of this Association paid a visit on Saturday last to the Mersey Dock and Harbour Board Pumping Station at the Brocklebank Dock, where there is a large gas engine installation.

Physical Society.—At the annual general meeting on Friday last, the Council reported that the number of ordinary Fellows on the roll was 430, a decrease of seven on the number last year. Twelve new Fellows had been elected. The treasurer stated that the assets of the society amounted to £4,013. Dr. Chree was re-elected president.

Suction Gas v. Electric Power.—We are indebted to Mr. F. V. L. Mathias, borough electrical and tramways engineer, Warrington, for the results of inquiries which he has addressed to many of his municipal colleagues on the subject named above. In passing, we are pleased to note that Mr. Mathias has adopted the excellent procedure of forwarding to each of the engineers who replied, a copy of the whole of the replies received. This is an equitable and courteous practice, which goes very far towards compensating for the trouble of furnishing the desired particulars. We have often commented on the annoyance caused to station engineers by the shower of questions they are invited to answer, for the sole benefit of others, and have suggested that the replies should be made available to the public. By following this course, the inquirer becomes a benefactor instead of a nuisance to his fellow engineers.

Mr. Mathias inquired for particulars of cases in which people had tried suction-gas power and found it wanting. The replies number some 91 in all, including 10 from companies. We were prepared to find that a fairly large minority of undertakings had experienced trouble owing to the competition of suction gas plant with electric power; we are surprised, however, to find with what complete unanimity this form of competition is reported to be quite harmless to the electricity supply industry. In very many cases no such competition has been experienced at all; in a very large number of replies instances of failure of suction gas plant, owing to its unsatisfactory working, are given, often with the result that electric power has been adopted instead. Thus, at Battersea, several firms are anxious to dispose of their gas plant, and to adopt electricity, but *cannot find purchasers for the former*. At Fulham a 120-h.p. plant, "which gave endless trouble," has been replaced with two-phase motors. Hackney charges £1 per kw. per quarter and ½d. per unit, prices which "are proof against suction gas." At Shoreditch, Stepney, St. Pancras, Accrington, Blackpool, Cardiff, Colchester, Croydon, Dewsbury, Dudley, Dundee, Govan, Greenock, Halifax, Leeds, Luton, Maidstone, Sheffield, South Shields, Watford, West Bromwich and West Ham, suction gas plants of all sizes up to several hundred horse-power have been abandoned and electric motors have been substituted.

In numerous instances electric motors acting as stand-by to suction gas plants are earning a good income; in many other cases manufacturers who have tried suction gas are using electricity for all extensions and in new works. Successful competition with suction gas proposals is reported from various quarters. The actual cost of fuel alone for suction gas power is stated to be over 1d. per unit, and at Bradford, Dudley, Dewsbury and other places, users state that electricity at 1d. a unit is cheaper than suction gas. At Colchester a large engineering firm, having tried suction gas for two years, experienced so much trouble that it preferred to pay for a large distributor and use electricity at 1d. a unit. At Dundee a 6-15-h.p. plant cost £84 10s. per annum inclusive. At Loughborough one suction gas plant was installed, but proved such a bad advertisement that no other has been put in there. At West Bromwich three 50-h.p. engines in a large ironworks cost 0·6d. per unit for fuel, and 1·5d. to 2d. for water, wages and repairs. The engineer there considers that electricity *has had* a competitor in suction gas, but the extravagant claims made for the latter have injured the cause. "20 h.p. for one hour for 1d." Surely Nemesis has overtaken the authors of this mendacious phrase, against which we have energetically protested on various occasions.

Commercial morality apart, it never pays to put forward exaggerated claims, least of all in matters in which the truth can be so easily ascertained.

We have never regarded the suction gas plant as an enemy to the electrical industry, and we do not rejoice in its downfall; we hoped that by its means electricity supply could have been introduced into the innumerable small towns and villages, which are still without a supply. Downfall, however, it appears to be, and for once our friends of the town gas industry, who had nothing to gain, but much to lose, from the success of suction gas, will be able to derive some consolation from our pages. For some of the firms which have abandoned the suction gas producer, to make the best of a bad job, have turned town gas into their engines.

A Manufacturers' Association's Report.—We have received from the secretary of the Manufacturers' Association of Great Britain, of Queen Anne's Chambers, Westminster, a copy of what appears to be a review of the year's work of that body. If judged by the title, the Association is at once ambitious and comprehensive—it could hardly be more so—but no figures are given as to its membership or as to the trades represented by it. The review, which is ascribed to Mr. G. Byng, as chairman, claims that the results achieved are evidence of what can be accomplished by manufacturers through combination and co-operation, yet, further on, we read that "a hundred times more might be done if manufacturers would only recognise the value of combination and co-operation." This compels us to the remark that co-operation in the hands of a few is more likely to have successful results than when it is applied *en masse*. A list of the membership might throw some light on whether the success achieved relates to co-operation as a general principle or co-operation as rigidly applied to one particular trade. Co-operative action in regard to broad principles we thoroughly approve of, but co-operative working in matters of detail between men of like trades is unlikely to have a beneficial and lasting effect. We hardly think it likely that the results obtained by this Association, embracing a few representatives of many trades can be held to convey an idea of what would be accomplished by the electrical trade in co-operation, for although the Association includes among its members what is undoubtedly one of the largest and most eminent electrical manufacturing concerns in the United Kingdom, it is not a representative electrical manufacturers' association. Yet it claims to be the "only body in existence in England entirely representing the manufacturer." This again, like the title, seems to us to be a trifle too ambitious. The document before us refers to the great decrease in trade last year, as compared to the most prosperous years that we have ever had, and is pessimistic concerning the outlook, for it hazards a doubt whether the lowest point of the depression has yet been reached. We are vouchsafed the information which has been stated in these pages and in other places over and over again in recent years, that "British manufacturers do not attach sufficient importance to Colonial trade, neither do they fully appreciate the valuable opportunities that exist for the employment of capital in Colonial enterprises." We should have suggested that a remedy for this lies in manufacturers being persuaded to "attach sufficient importance" and to "fully appreciate," but this report ignores that, and suggests closer commercial relations between the Mother Country and the Colonies and an intelligent effort by the Government to co-ordinate the laws and regulations controlling Empire trade, industry and shipping. We read further on that there is at present "no common standard from which one could judge the prosperity or otherwise of a country or the general financial condition of a market." That being so, why are writers and speakers of a particular following so ready to make comparisons which they calculate will strengthen their case and will make our position appear as bad as can be? If the basis of comparison be not reliable, the deductions are bound to be unreliable, too. The Association claims to have *discovered* that foreign firms are working the Colonial market from Great Britain and securing the entry of their goods into certain Colonies under the preferential duties and are thus destroying the principle of preference. Toward the end of Mr. Byng's statement, some remarks appear concerning the serious position of manufacturing in Great Britain at the present time, in which he says: "The foreign trade that is growing in our home markets is the trade in the manufacture of which we were a few years ago supreme." It could not be as an electrical manufacturer that Mr. Byng was speaking, for he of all men ought to know that undercutting between British firms has been more responsible than anything else for the unprofitableness of some electrical businesses; further, he was, as chairman, representing *all* manufacturing, we presume (or all that is represented in the Association membership). He does not see how things will be improved until the country is governed by men who are watchful of the interests of the manufacturer and trader, and he makes further remarks which suggest something after the manner of a Ministry of Commerce such as the Electrical Review has advocated on several occasions. We are glad to observe the remark that the Association has "absolutely no concern with party politics," and we will try to believe it. We will also try to believe that the Association is carried on "in the interests of British industry as a whole."

The Electra Turbine.—Some recent tests on this turbine, a modified form of the de Laval type, are given in the *Génie Civil*. The turbine was coupled to an alternator, giving 90 k.v.a. at 3,000 r.p.m., and was supplied with steam at 142 lb. per sq. in., superheated to 300° C.; the absolute pressure in the condenser was somewhat over 1·4 lb. per sq. in. The total consumption of steam over a range of 30 to 140 h.p. was found to be represented by a straight line law according to the equation—$w = 184 + 13·9$ h.p., where w is the steam consumed per hour in lb. and h.p. the brake-horse-power. From this it follows that the consumption per h.p.-hour was at quarter-load, 21·5 lb.; at half-load, 17·7 lb.; at full load (94·5 h.p.), 15·85 lb.; and at 35 per cent. overload, 15·3 lb. The makers guarantee the consumption of a 600-h.p. turbine at full load to be not more than 13·2 lb. per h.p.-hour under similar conditions.

Appointments Vacant.—Sales engineer for the Yorkshire Electric Power Co. (£3 + commission); chief engineer for Gloucester Corporation electricity and refuse destructor works. See our advertisement pages for particulars.

Veritys' Employés and the Army.—Messrs. Veritys, Ltd., are granting an extra week's holiday, in addition to the time required for training, to members of their various staffs who also belong to the Home Guards. A large number of this firm's employés at their works at Aston, Birmingham, have joined the three Southern Telegraph Companies R.E. (Army Troops) commanded by Lieut.-Col. J. F. Listen, who is a director of Veritys, Ltd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Exeter T.C. has increased the salary of the electrical engineer from £400 to £425 per annum. The E L. Committee had recommended an increase of £50, but this was rejected by 23 votes to 15.

Mr. Thomas R. Burrell, who has for over 16 years been engineer for the Windermere and District Electricity Supply Co., is about to leave for New Zealand.

General.—Acting on the powers conferred upon them by the articles of association, the Council of the Institution of Electrical Engineers have unanimously elected Mr. A. H. Walton to the seat on the Council rendered vacant by the retirement of Prof. A. Schwartz.

At Marlborough House on 11th inst. the Prince of Wales, as President of the Royal Society of Arts, presented the Albert Medal to Sir James Dewar, "for his investigations into the liquefaction of gases and the properties of matter at low temperatures, investigations which have resulted in the production of the lowest temperatures yet reached, the use of vacuum vessels for thermal isolation, and the application of cooled charcoal to the separation of gaseous mixtures and to the production of high vacua."

The electrical staff of Messrs. Head, Wrightson & Co., Ltd., Thornaby-on-Tees, have presented a purse of gold to Mr. Payne, who is leaving to take up a position at Glasgow.

Mr. R. N. Duncan, who was for a number of years inspector of electric and hydraulic lifts and machinery generally to the Postmaster-General, has been appointed manager of the London office of Messrs. A. and P. Steven, lift manufacturers, &c., of Thanet House, 231-2, Strand, W.C.

The firm of Bruce Peebles & Co., Ltd., has been successfully reconstructed, and is now in active operation. Mr. Fred. E. Andrews has been elected chairman of the board of directors, and Mr. Lee Murray, M.I.C.E., has been appointed general manager. Mr. Andrews was for very many years connected with the Brush Electrical Engineering Co, both in London and at Loughborough, and Mr Murray will be well known by his long connection with Messrs. Siemens Bros. in different parts of the world, and latterly (as mentioned in our last issue) as manager of their works at Stafford.

Obituary.—We regret to learn that Mrs. Jamieson, the wife of Prof. Andrew Jamieson, F.R.S.E., died on the 22nd ult. She was a woman of many accomplishments, and was widely known and very popular amongst cable electricians and telegraphists when her husband was chief electrician to the Eastern Telegraph Co., as well as amongst his staff and students at the Glasgow Technical College.

We record with deep regret the death of Mr George Edward Belliss, founder of the business of Bellis & Morcom, Ltd., of Ledsam Street Works, Birmingham. Mr. Bellis commenced business in Birmingham in 1862, and according to the *Daily Telegraph* he began to make marine engines 40 years ago. In 1884 he was joined by Mr. Alfred Morcom in the business which is known in all parts of the world to day. The deceased gentleman was in his 71st year.

NEW COMPANIES REGISTERED.

La Plata Electric Tramways Co., Ltd. (101,431).—This company was registered on February 4th, with capital of £450,000 in 200,000 preference and 250,000 ordinary shares of £1 each, to adopt an agreement with La Plata and Ensenada Tramways Co., Ltd., and the liquidator thereof, to acquire or construct, equip, maintain and work tramways, railways and lines of telegraph, telephone or other means of communication in Argentine Republic or elsewhere, and to carry on the business of tramway and railway proprietors, carriers of passengers and goods, electricians, electrical engineers, proprietors of motor omnibuses and other conveyances, &c. The subscribers (with one share each) are:—W. J. Yeoman, 141, East Dulwich Grove, S.E., clerk; A. W. Lawson, 14, Rosebery Gardens, Crouch End N, secretary; T. Winter, Northcote, Sidney Road, Beckenham, secretary; H. Dixon, jun., 68, Beresford Road, Hornsey, N., clerk; A. E. Killick, 30, Earlsfield Road, Wandsworth Common, S.W., accountant; F. W. Dickson, 66, Church Crescent, Muswell Hill, N., clerk; M. A. Waite, 1, Exeter Road, Brondesbury, N.W., clerk. Minimum cash subscription 75 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than five; the first are W. F. Hamilton, K.C., 4, Stone Buildings, Lincoln's Inn, W.C. (late director of Buenos Ayres and Belgrano Electric Tramways Cd., Ltd); J. S. Harmood-Banner, M.P., 11, Old Jewry Chambers, E.C. (director of British Insulated and Helsby Cables, Ltd); W. T. Western, 44, Charing Cross, S.W. (chairman of Rosario Electric Co., Ltd.); and W. Murray Wilson, 23, South Drive, Harrogate (late chairman of Union Tramway Co., Monte Video); qualification, 250 shares; remuneration, £200 each per annum (chairman £300), and 10 per cent. of the net profits remaining after 6 per cent. has been paid on the shares, divisible. Registered office, 52, Moorgate Street, E.C.

Pacific Radio-Telegraph Co., Ltd. (101,448).—This company was registered on February 5th, with a capital of £60,000 in £1 shares, to acquire powers for the construction, maintenance and working of a system or systems of intercommunication by means of radio-telegraphy between the islands of the Pacific Ocean and the territories of Australia and New Zealand, and to carry on the business of a telegraph, telephone, submarine cable and wireless telegraph company in any part of the world. The subscribers are:—Earl of Crawford, 2, Cavendish Square, W., 100 shares; J. T. Arundel, 24, FitzGeorge Avenue, West Kensington, N.W., merchant, 100 shares; Sir Sidney H. C. Hutchinson, Kt., 22, Edith Road, West Kensington, 100 shares; J. W. O. Hamilton, Grosvenor Hotel, Buckingham Palace Road, S.W., civil engineer, 100 shares; J. S. Blomfield, Hillthorpe, Sydenham Hill, S.E., Australian merchant, 100 shares; A. F. Fox, 17, Campden Hill Gardens, Kensington, W., solicitor, 1 share; F. W. Cattermole, 21, Eluthna Street, Clapham, S.W., clerk, 1 share. Minimum cash subscription, £500. The number of directors is not to be less than four or more than nine; the first are the Earl of Crawford, J. T. Arundel, Sir Sidney H. C. Hutchinson, Kt., and J. W. O. Hamilton; qualification, £100; remuneration (except managing director) as fixed by the company. Registered office, 54, Old Broad Street, E.C.

Voss & Co., Ltd. (101,541).—This company was registered on February 11th, with a capital of £2,500 in £1 shares, to acquire the business carried on at 14-15, New Yard, Great Queen Street, W.C., as "Voss and Co.," to adopt an agreement with E. Wilding, and to carry on the business of electrical and mechanical engineers, scientific instrument makers, &c. The subscribers (with one share each) are:—E. Wilding, Dashwood House, 9, New Broad Street, E.C., chartered accountant; A. W. Cox, 7, Hemington Avenue, Friern Barnet, traveller. Private company. E. Wilding is permanent director, subject to holding 2,000 shares. Registered office, Dashwood House, 9, New Broad Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Jarrow and District Electric Traction Co., Ltd. (78,680).—Particulars of £19,000 debentures created November 17th, 1908, the security being defined by an agreement dated January 19th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Waterworks, Lighting and Power Investment Corporation, Ltd. (88,390).—Issue on October 6th, 1908, of £100 debentures, part of series created August 18th, 1906, to secure £10,000, charged on the general property, including uncalled capital. No trustees. (Present issue registered February 2nd, 1909.)

Magnetic Separator, Ltd. (81,392).—Five per cent. debenture dated January 15th, 1909, to secure £50, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: H. Higginbottom, 21, Spring Gardens, Manchester, and P. Higson, 42, Spring Gardens, Manchester.

Metropolitan Electric Tramways, Ltd. (42,526).—Particulars of £200,000 second debenture stock, created Dec. 22nd, 1908, and secured by trust deed dated January 21st, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Power is taken to issue further stock, ranking *pari passu*, up to quarter of the issued capital for the time being. Property charged: The assets and undertaking of the company now comprised in and charged by indentures dated April 28th, 1904, and May 28th, 1906, between the company and the Electric and General Investment Co., Ltd., and the general property, including uncalled capital. Trustees: Electric and General Investment Co., Ltd., 1-2, Gt. Winchester Street, E.C.

Ogmore Valley Electric Light and Power Supply Co., Ltd.—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: 5 per cent. debenture bonds dated April 16th, 1894, securing £1,700.

Harrow Electric Light and Power Co., Ltd. (44,529).—A memorandum of satisfaction in full of debentures dated April 1st, 1898, and November 15th, 1900, securing £15,000, has been filed.

Kramos, Ltd. (82,859).—Particulars of £1,700 debentures created February 22nd, 1905, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £500 (renewals). Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Key Engineering Co, Ltd. (76,549).—A memorandum of satisfaction in full of debentures dated February 10th, 1901, securing £2,000, has been filed. Particulars of £3,500 debentures created December 23rd, 1908, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being issued on January 26th, 1909. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British "Ever-Ready" Electrical Co., Ltd. (71,891).—This company's annual return was filed January 2nd, when the entire capital of £8,000 in £1 shares had been taken up. £8,000 has been received. Mortgages and charges: £7,000.

Chesham Electric Light and Power Co., Ltd. (90,833).—This company's annual return was filed on January 8th, when 15,007 shares had been taken up out of a nominal capital of £25,000 in £1 shares. £7 has been received and £10,000 is considered as paid. Mortgages and charges: £8,200.

Thomas R. Martin & Co., Ltd. (90,825).—Five per cent. first mortgage debenture, dated January 28th, 1909, to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Cleveland Investment Co., Ltd., 37, Albert Road, Middlesbrough.

Hankow Light and Power Co., Ltd. (87,331).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: First mortgage, dated April 3rd, 1908, securing £4,405 15s. 9d. Second mortgage, dated December 18th, 1908, to secure £1,000, charged on land in Russian concession at Hankow, with machinery and fixtures erected or to be erected. Holders: S. Apiel, 41, Queen Street, E.C., and J. Macgregor, 14, Union Court, Old Broad Street, E.C.

Anglo-Argentine Tramways Co., Ltd. (25,663).—Supplemental trust deed dated January 22nd, 1909, to secure £3,900,674 further 4 per cent. stock, redeemable at 102 per cent., ranking *pari passu* with £565,000 4 per cent. debenture stock, covered by trust deed of June 2nd, 1908. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject only to £226,000 6 per cent. debenture stock, so long as same is outstanding (which stock is to be redeemed by exchange for a portion of this further stock), and to a charge created in January, 1905, in favour of the Buenos Ayres Tramways Co. (1904), Ltd. Trustees: Law Debenture Corporation, Ltd.

Christy Bros. & Co., Ltd. (90,039).—Issue on January 25th of £300 debentures, part of a series created November 2nd, 1908, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital.

Thomas Potter & Sons, Ltd. (84,541).—Debenture dated January 15th, 1909, to secure £4,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. M. Gale, Crookley, Horndean, Hants.

South London Electric Supply Corporation, Ltd. (50,392).—A memorandum of satisfaction in full of charge dated February 5th, 1907, securing £80,000, has been filed.

(*Continued on page* 310.)

ELECTRICITY SUPPLY IN BRISTOL, 1909.

(*Concluded from page* 264.)

In our last issue we referred to the new E.H.T. switchboard which Messrs. Siemens are erecting at the Avonbank generating station; through the courtesy of the firm we are able to give some further details of this equipment and certain other work which is being carried out.

The new board is arranged to control three generators, six 1,000-KW. trunk feeders, nine 500-KW. feeders and the 300-KW. motor-converter installed in the station.

Each generator panel is equipped with two reverse relays, an ammeter in two of the phases, an indicating wattmeter and a watt-hour meter. The oil-switch trip coils are operated from a special direct-current auxiliary bus-bar.

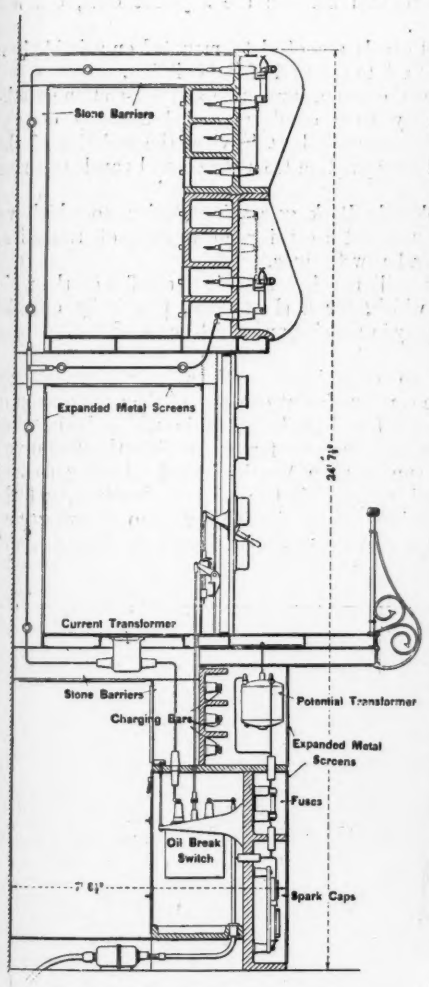


Fig. 9.—Sectional View of New Siemens E.H.T. Switchboard, Avonbank Generating Station.

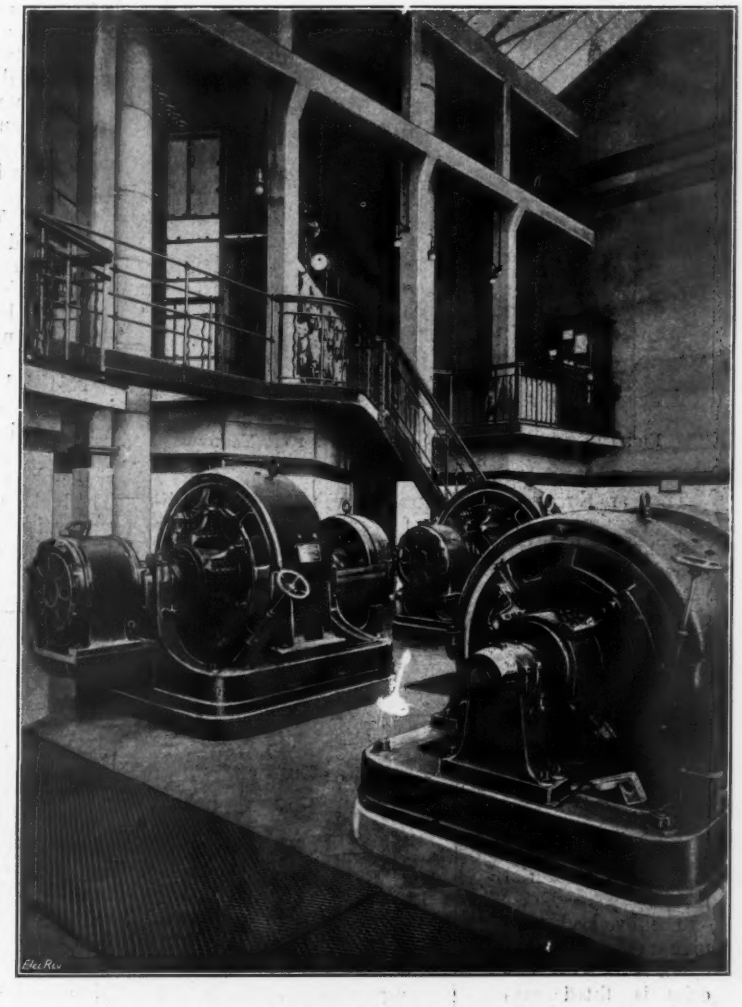


Fig. 10.—Interior of the Underfall Yard Sub-station, Bristol, showing Converters, and E.H.T. Switchgear on Gallery.

Cellular work of moulded "Empire" stone is employed for sub-dividing the H.T. gear (as shown in fig. 4, page 262); duplicate sets of bus-bars are provided, these can be paralleled or either set can be sub-divided.

Our sectional view, fig. 9, shows the cable connections from the trifurcating box to the oil switch—which latter is hand-operated and provided with release coils which are operated from the reverse relays; the leads are then taken through current transformers direct to selector switches by which they can be connected to either set of bus-bars. These selector switches, which also act as isolators, are provided with horns to ensure rapid extinction of the arc should it be necessary to break current at this point.

Each trunk panel is equipped with selector switches, a main oil switch with two overload trip coils, and two ammeters.

A "mains charging device" consisting of a regulating transformer is provided, connected to a special set of bus-bars, which can be connected by special switches to any of the trunk mains or feeders.

The equipments of the feeder and the motor-converter panels are practically the same as those for the trunk mains.

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A panel is also provided for coupling up the two sets of bus-bars, the equipment consisting of two sets of isolating switches, one oil switch with overload trip coils, and two ammeters.

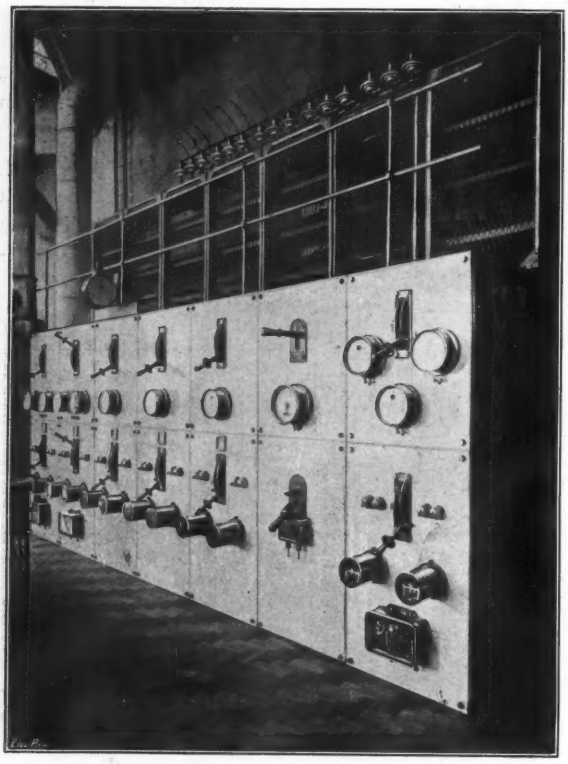

Fig. 11.—E.H.T. Control Panels, Underfall Yard Sub-station.

There are three sets of electrostatic voltmeters for indicating the pressure on the sets of main bus-bars and on the charging bus-bars respectively. Each instrument is connected between one-phase and the neutral earth-bar. The synchronising gear is carried on swinging brackets arranged on either end of the switchboard.

The oil switches consist of three single-pole switches built into separate stonework cells, and coupled together by mechanical means.

The overload tripping mechanism on the trunk and feeder circuits is fitted with air-vane time limits (Palairet patent), which are set to give about 20 seconds lag normally. The time lag can, however, be varied within very wide limits if desired.

With the exception of the electrostatic voltmeters, which are of Messrs. Kelvin & White's make, the whole of the instruments were supplied by Messrs. Siemens Bros.

Messrs. Siemens are also equipping five static three-phase sub-stations; two of these (Clouds Hill and Cowper Street) control three 500-kw. 6,000-volt three-phase incoming and outgoing feeders; one controls three incoming feeders of the same size, and another also deals with three incoming and outgoing feeders.

The switchgear at Clouds Hill sub-station is very similar to the remainder, except as regards number of panels.

In this case after leaving the cable box, the leads are taken through the main oil switch, which is provided with two overload relays to operate the trip coils, and open the main switch in case of overload.

The incoming and the outgoing feeder panels are practically alike, the difference being that the incoming oil switch is of the double-throw type so that current may be switched on to either the bus-bars or direct on to one of the outgoing feeders. In addition, the incoming feeders are provided with reverse-current relays. Every feeder circuit is provided with one ammeter.

Each bus-bar is enclosed in a separate stonework compartment fitted with inspection doors. Artificial stonework barriers are provided between the adjacent cells, but not between phases.

The control panels are of slate mounted on suitable iron supports and fixed to the wall of the building.

In designing the generating station and sub-station switchgears, immunity from accidents and the safety of the operator were constantly kept in view, the isolation of the H.T. gear and its separation from the control panels ensuring this.

The old Temple Back generating station, to which we have already referred as being in a state of transition, embodies several new features.

Our readers will recollect the disastrous fire on the main switchboard which, for a short time, practically crippled electricity supply in the city, and which occurred at Christmas, 1903.

This led to extensive alterations in the switchgear, including the construction at one end of the engine room of a special fireproof switch building, in which is installed modern Siemens switchgear for controlling the 2,000-volt single-phase supply from Avonbank and outgoing feeders. The building is arranged in two separate chambers, and the supply is duplicated in each with a view to ensuring continuity in supply as regards the large single-phase network

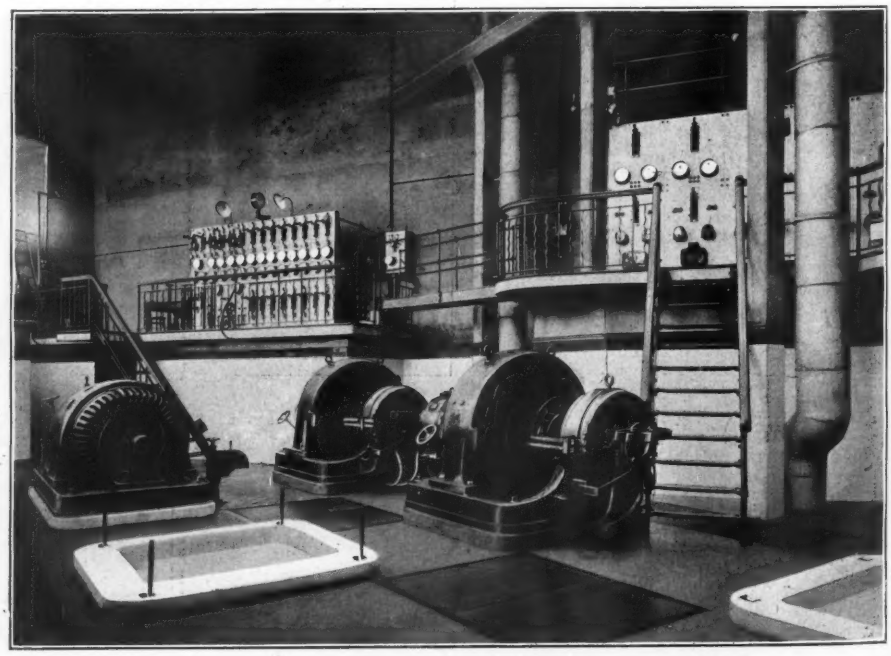

Fig. 12.—Underfall Yard Sub-station, showing Direct-Current Switchboard, &c.

fed from this point. Views of this switchgear were given in figs. 7 and 8, page 264.

A new Siemens direct-current board has also been installed on the old switch gallery overlooking the engine

room; this board, which was shown in fig. 5, and includes four machine, 18 feeder and two balancer panels, is for controlling the direct-current power circuits radiating from Temple Back. The most recent development at this station, however, which was rendered possible by discarding a portion of the original boiler and engine plant, is the conversion of a one end of the buildings into a rotary sub-station fed with three-phase current from the Avonbank works.

This sub-station contains four 500-KW. Peebles motor-converters, each with an overload capacity of 25 per cent. for two hours. These machines operate at 6,000-6,600 volts and 50 cycles on the E.H.T. side, and supply direct-current at 500 and 250 volts over a three-wire system. The machines are all flat compounded, and arranged to give their full KW. output at any voltage within the limits mentioned.

The three-phase and direct-current switchgear in this sub-station was also supplied by Messrs. Siemens.

A large amount of the original steam generating plant is still retained in the Temple Bank Works, being regarded, except at times of heavy load, as a stand-by to the newer plant at Avonmouth; this includes 11 boilers and 10 generating sets, eight of the latter being for supplying direct-current for power and arc lighting, and two for supplying the 2,000-volt alternating circuits.

The Underfall Yard sub-station is a reinforced concrete building with an equipment consisting of two 300-KW. Westinghouse rotary converters, and one 300-KW. Peebles motor-converter, the three-phase and direct-current switchgear being by Messrs. Siemens. Views in this sub-station are shown in figs. 10 and 12. The Westinghouse rotaries are wound six-phase and fitted with an induction starting motor and 35-KW. A.C. booster to give up to 40 volts; the necessary transformers, three of 110-KW. capacity each per machine, are installed beneath the machine. The transformers are mesh connected on the primary and star connected on the secondary side.

The Peebles motor-converter is a modern type machine designed for 6,600 volts A.C./500-550 volts D.C., with the motor field regulating switch (by Bray, Markham and Reiss) adjacent and resistances in a pit below.

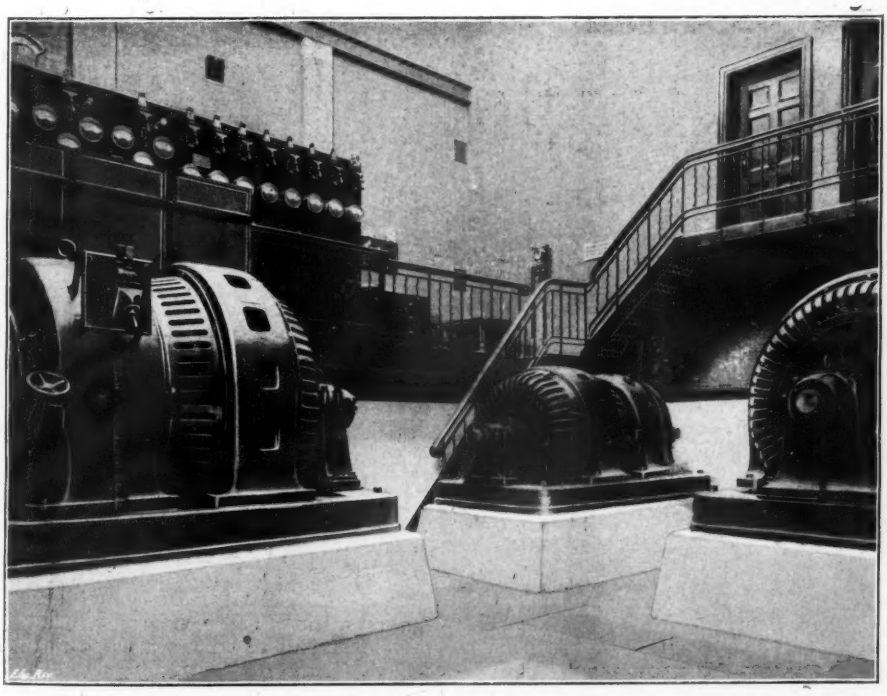

FIG. 14.—INTERIOR OF THE AVONMOUTH SUB-STATION, SHOWING PEEBLES MOTOR-CONVERTERS.

The various basements are connected up to a cable trench running round the building, the E.H.T. feeders and L.T. distributors, entering and leaving at opposite ends of the building.

Figs. 11 and 12 show the E.H.T. three-phase and L.T. direct-current switchboards, which are mounted on a gallery; the former consists of an operating board of seven panels (three feeder, three machine and one starting motor panel), with the bus-bars, instrument transformers, &c., mounted in

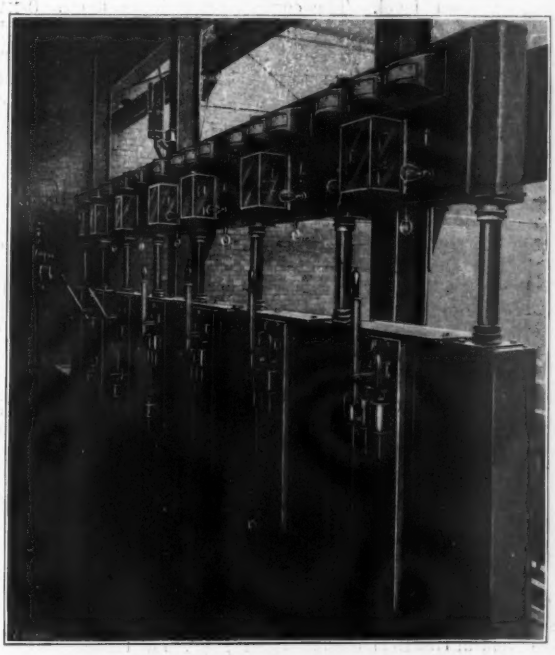

FIG. 13.—B.T.-H. CONTROL PANELS, E.H.T. SWITCHGEAR, AVONMOUTH SUB-STATION.

stone cubicles behind, which are continued down below the gallery and also contain the oil switches.

The operating panels for the machines and feeders (shown in fig. 11), are each fitted with selector and main switch handles, mechanically coupled to the oil switches below, one ammeter and Ferranti reverse relays on two phases, the machine panels having overload relays in addition. The panel for controlling the induction starting motors is shown on the right (fig. 11) and the apparent difference in design of the second panel is due to its being of Westinghouse make. Our view shows the horn-type lightning arresters, which operate in conjunction with a water resistance, at the back of the cubicles.

The direct-current board, fig. 12, consists of white marble panels equipped for controlling three machines and eight feeders. The machine panels are equipped with time-limit cut-outs on both positive and negative sides—maximum on the former—and minimum cut-outs are fitted on both positive and negative feeders. A 5-ton travelling crane, hand operated by ropes, is provided for repairs and erecting. The output from this sub-station is largely absorbed by the

British Imperial and British American Tobacco Companies' factories and by the Docks Committee for pumping purposes. Local street and private lighting is also supplied.

The Avonmouth sub-station is another good example of this class of structure. The building is of brick, but in place of the usual foundations it stands on a concrete flat, which is supported on concrete piles in some places 3 ft. above the ground level. The equipment includes two 500-KW. Peebles motor-converters and a similar 300 KW. set—the machines being mounted on deep concrete foundations above the floor level, as shown in fig. 14. In this case the unrestricted building area has enabled the designers to adopt an ideal arrangement of switchgear, the direct-current gear being mounted on a gallery at one side of the building and facing the three-phase switchgear—mounted on two galleries—on the opposite side (fig. 17). The whole of this switchgear has been supplied by the British Thomson-Houston Co.; the E.H.T. three-phase operating board, fig. 13, situated on the top gallery, controls the three incoming feeders and three machines, a further machine panel being provided for future use. All the panels are provided with overload and reverse-current relays, an ammeter in each phase on the feeder panels, and one ammeter and power-factor meter in the case of the machine panels.

The E.H.T. bus-bars are enclosed in a fireproof cellular structure facing the operating board on the top platform, and connected through isolating link switches to the oil switches which are similarly enclosed in a cellular structure on the lower gallery. The isolating and oil switches are interlocked so that the oil switches must be opened before the isolating switches. The oil switches, each consisting of three single pole switches coupled together, are mechanically operated; the terminals are coupled through to trifurcating boxes in adjoining cells, shown in fig. 15, where also are current and potential transformers and spark gaps. The machine switches have charging water-resistances arranged as shunts, with a view to protecting the H.T. machine windings against current surges; the solenoid trips are energised from a 16-cell battery situated under the lower gallery.

The direct-current switchboard, shown in fig. 16, includes

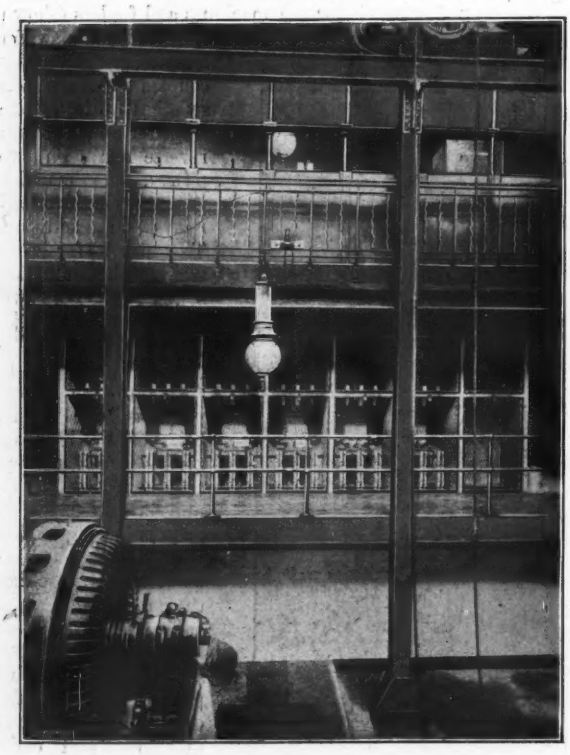

FIG. 15.—E.H.T. SWITCH GALLERIES, AVONMOUTH SUB-STATION.

panels for the three machines in use, a future machine, and for four feeders. Each machine panel is fitted with a breaker on the negative side (the positive breaker being mounted on the machine), and knife and equaliser switches, also with a voltmeter, a recording wattmeter and ammeters; the feeder panels are provided with both positive and negative circuit-breakers. On the edge of the gallery are situated three Bray, Markham and Reiss starting panels for

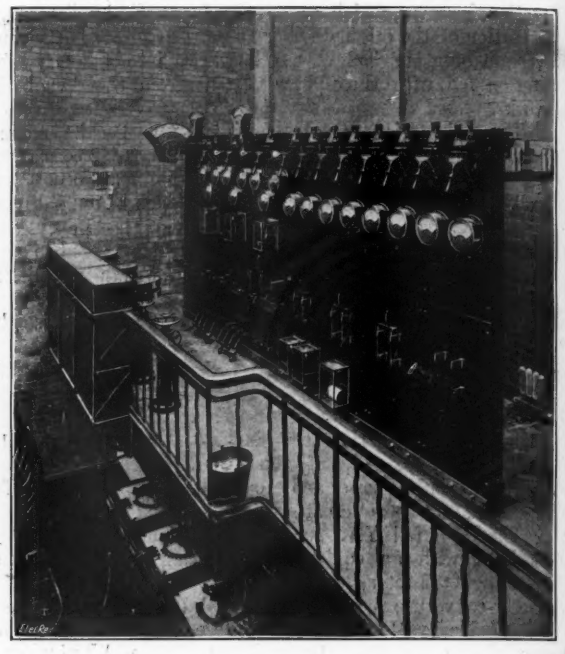

FIG. 16.—DIRECT-CURRENT BOARD, AND STARTERS FOR MOTOR CONVERTERS, AVONMOUTH SUB-STATION.

the converters, with hand-wheel pillars—the spindles of which pass down to rheostats below the gallery (seen in fig. 16). When starting the motor generators from the D.C. side it is, of course, necessary for the operator to obtain the correct synchronising speed by regulating the field of the machine on the direct-current switch gallery; it, therefore, became necessary to arrange for closing the E.H.T. oil switch from that point.

As it was desired to avoid the use of motor or solenoid operated switches in this sub-station, a special type of spring-operated switch was provided. In starting-up, the E.H.T. switch handle is first closed, compressing a spring, but leaving the switch held open by a toggle; when the moment of synchronism arises the toggle is tripped through a push button circuit from the D.C. switch gallery.

With the exception of two of the Temple Back machines, all the motor-converters are of the latest type, with only two bearings, and with the A.C. rotor and D.C. armature windings on opposite ends of a common spider.

The direct-current ends of the machines are provided with commutating poles, and the machines occupy much less space than as originally designed.

All the Bristol converters are arranged to be self-balancing on a three-wire network; this is effected by bringing the neutral wire to the star point of the rotor winding, an arrangement which makes it possible to maintain practically constant voltage across either side of the system with large out-of-balance loads.

The three Avonmouth machines are particularly interesting in this respect, as they were designed for maintaining constant voltage within a very small percentage between either side of the system, when one side of the machine is fully loaded and the other unloaded.

In this particular case this arrangement enabled a number of 250-volt motors, which were previously supplied by a small gas engine plant, to be connected direct to the new sub-station.

This sub-station is, of course, primarily intended for supplying the Avonmouth docks and any industries in connection therewith; the present load, which includes 17 cranes, a granary, 100 arc lamps and the whole of the incandescent lighting of the dock building and estate, is supplied through a small switch house on the dock estate, containing the electricity department's terminal board and

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meter and a distribution board under the control of the dock authorities.

For the lighting of Shirehampton, a township on the route of the trunk feeders, one of the latter has been looped into a static sub-station, the L.T. side of which is to be controlled, according to present arrangements, from the Avonmouth sub-station. The latter, it may be mentioned, has been designed with a view to future developments, considerable office accommodation being provided.

During the last official year some 10 million units were generated at the Corporation's stations, and of this quantity over 7½ million units were supplied for power and lighting; the maximum demand amounted to 5,942 KW. out of some 12,300 KW. of load connected.

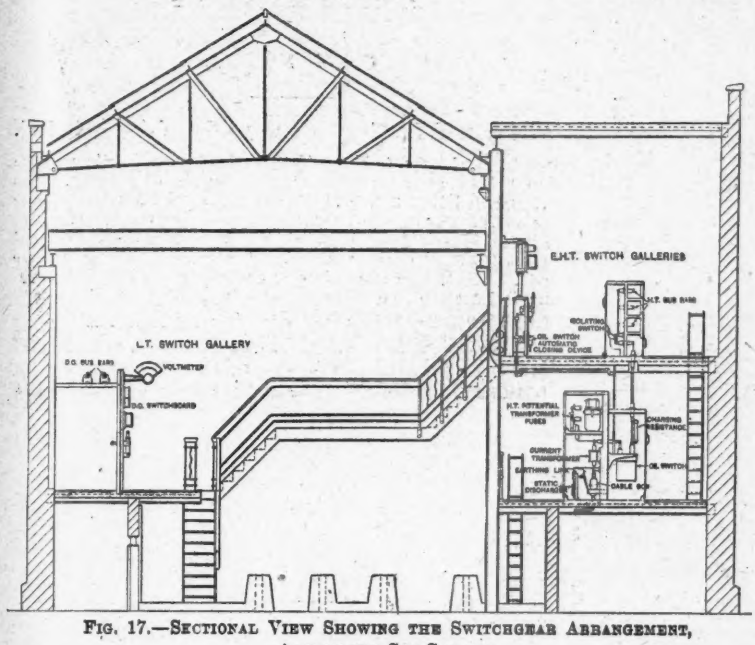


Fig. 17.—Sectional View Showing the Switchgear Arrangement, Avonmouth Sub-Station.

A most noticeable feature in Bristol, as elsewhere, is the rapidly increasing motor load, which now much exceeds that for private lighting.

Thus, during the past three years the units supplied were as follows:—

	1906.	1907.	1908.
Lighting	2,793,993	2,966,579	3,088,005
Power	2,183,373	2,619,830	3,718,296
Public lighting ...	833 602	831,737	843,773
Total ...	5,810,968	6,418,146	7,650,074

Over 7,000 H.P. of motors and heating apparatus are connected to the system, and the total number of consumers of all sorts is over 3,000.

As will be gathered from the foregoing, the Bristol lighting system is particularly favourable to the users of metallic-filament lamps of reasonable candle-powers, and it is, therefore, not surprising that the more efficient lamps are making great headway in the city.

In conclusion, we are much indebted to Mr. H. Faraday Proctor, the city electrical engineer, for allowing us to place on record the recent developments in connection with his undertaking.

Fixation of Nitrogen.—It is mentioned in the report for 1908 of the Gesellschaft fur Luftstickstoff Verwertung, of Wiesbaden, that the year continued to be a period of preparatory work. The furnace house, including the electrical equipment of the furnaces and the engine house, was completed, as also the construction of the conduits with valve governors and equipment for utilising the superfluous heat. The orders for the machines and apparatus for the nitrate installation were placed, and provisional arrangements had been made which would render possible the working up of the small quantity of nitrate expected in the course of the next few months. The low level of the water until the middle of April will not permit of a large quantity of energy being available before that time, although six furnaces of a combined output of 3,000 H.P. were experimentally started at the end of January.

BRAKE BLOCKS.

The January issue of the Official Circular of the Tramways and Light Railways Association contains a short article on the best material and the best form of brake blocks for electric trains, a subject which has been given a desultory sort of attention now and then, but is well worth threshing out to the last point in the interest of all tramways. Its significance can be gauged well by the fact recently noted in an American exchange that the exercise of care in the selection of material, and in seeing that the utmost life is obtained from each block, has resulted in the reduction of the cost of brake blocks per care-mile to just half what it was before real interest was taken in the matter. In America, too, largely through the agency of the Master Car-Builders' Association, brake blocks and their attachments have been standardised to a considerable extent. In England, on the other hand, one may find in any large car shed where there are trucks of several makes, as many different methods of hanging the brakes, and as many different designs of brake heads and brake blocks, the result being that a far larger stock of parts has to be kept, and greater skill is required of the men who keep the brakes in repair.

The Tramways and Light Railways Association Committee very properly suggests that a standard block should be established, and the writer of the article mentioned above endeavours to place before his readers the essential points which are involved.

Obviously, the function of a brake block is to create friction, and it may be said shortly that the best block is that which will create the most friction, or will dissipate the most heat, under all conditions.

But friction depends upon the internal structure of the material. If this be soft and tough, friction may be high under conditions of low heat generation such as are obtained with light cars, low speeds and small braking pressures. Increase any of these factors and the friction of the ordinary soft unchilled cast-iron block falls rapidly, owing to the high temperature.

On the other hand, very hard blocks are comparatively ineffective under the conditions most favourable to the softer material, but their frictional properties increase under heavier loads and speeds, their temperature increasing at the same time, until a point is reached when their retarding effect is better than that of the soft-iron blocks.

The general results are the same whether the wheel treads are chilled-iron or steel-tired.

The performance curves of these two kinds of block are essentially different; it is evident, therefore, that we should try to make a mixture in which the two effects are secured.

The author gives the following catalogue of blocks in general use:—

1. Plain cast-iron blocks with or without face chill.
2. End-chilled blocks with extended ends chilled from the back, giving the full bearing length of the face of the ordinary square-end block of unchilled iron with the projecting ends only chilled, the chill extending from the face to the back of the block, so that the retarding effect of this block is practically uniform from the time it is applied until removed as scrap. The block is distinguished from the ordinary face-chilled square-end block because the face-chilled block gradually losses its chill as it wears down, and, in fact, finally becomes a soft iron block.
3. Brake blocks having a wearing surface made up of a combination of hard and soft metal by the use of inserts, either soft inserts in a hard body metal, or hard inserts in a soft body metal. The advantage of the end-chilled block and the block with special inserts is the uniformity of wear throughout the life of the block.

He endeavours to arrive at some comparison between the lives of the various makes of block, and, as his figures appear to be deduced from extensive laboratory tests as well as from

practical experience, they should be given respectful consideration. He takes the ordinary unchilled C.I. block as the unit, and finds that, *on the average*, the work done by other blocks for an equal amount of wear may be expressed as below :—

Block with whole face chilled ...	1·5 to 2
„ „ special chilled ends ...	2·5 to 3·5
Soft iron block with chilled inserts	2 to 4

Chilling reduces the strength of the block, and in order to obtain the extreme life which is expected, it is necessary to re-inforce the lug and the back of the block itself.

Brake blocks should be designed to be interchangeable, and brake heads should be made to take any block, and to hold the block with either end up. In this way the number of stock parts will be reduced, and the blocks can be worn almost to nothing. Too often it is the case that blocks are thrown on the scrap before they are half worn out, sometimes because the foreman and the engineer are not alive, but mostly because the block is suspended so that it wears taper, and cannot be reversed. Packing out effects a partial cure in some cases, but generally the best thing to do is to re-design the brake-gear.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

(*Continued from page* 304).

Walsall Electrical Co., Ltd. (37,696).—This company's annual return was filed on November 28th, when 12,000 shares had been taken up out of a nominal capital of £30,620 in £1 shares. £10,000 has been received and £2,000 is considered as paid. Mortgages and charges: Nil.

New Phonopore Telephone Co., Ltd. (44,654 C).—This company's annual return was filed on November 14th, when 6,741 ordinary and 1,000 founders' shares had been taken up out of a nominal capital of £10,000 in £1 shares (1,000 founders'). £1 per share has been called up on 5,511 and 15s. per share on 1,220 ordinary shares, resulting in the receipt of £6,278 10s. £155 remains in arrears. £1,000 is considered as paid on the founders'. Mortgages and charges: £2,500.

Electric Ignition Co., Ltd. (Birmingham) (83,984).—Particulars of £1,000 third debentures created December 30th, 1908, and secured by trust deed of even date, filed pursuant to Sec 10 (3) of the Companies' Act, 1907, the whole amount being now issued. The above-mentioned trust deed has also been registered. Property charged: Royal Wellington Works, Sampson Road North, Birmingham, and the company's undertaking and other assets, present and future, except uncalled capital. Trustees: F. Lewis and Constance Hall.

British Aluminium Co., Ltd. (London) (41,104).—A memorandum of satisfaction in full of charges dated May 19th and June 16th, 1908, securing £200,000, has been filed.

United Electric Tramways of Monte Video, Ltd. (80,456).—Particulars of £1,000,000 debenture stock created by resolutions dated October 28th, 1904, May 22nd and May 25th, 1906, and December 21st, 1908, and secured by trust deeds dated July 12th, 1905, June 19th, 1903, and January 7th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £200,000. The deed of January 7th, 1909, has also been registered. Property charged: 2,000 shares of $1,000 each in La Sociedad Comercial de Monte Video; 40 shares of $100,000 each in the said Monte Video Co., any debt that may be incurred by the Monte Video Co to this company in respect of advances, &c. Trustees: Major Sir William E. E. Gordon, 4, Chelsea Embankment, S.W.; Hon. Claude G. Hay, M.P., Basildon House, Moorgate Street, E.C.; and C. W. Trotter, Basildon House, aforesaid.

Topsham Electricity Supply Co., Ltd. (80,326).—Particulars of £300 second debentures created July 11th, 1907, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £300. Property charged: Company's property, present and future, including uncalled capital. No trustees.

Dennison, Kent & Co., Ltd. (100,769).—Debenture dated January 26th, 1909, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. W. Dennison, Fairmead, Grove Park, Kent.

Marples, Leach & Co., Ltd. (97,502).—Particulars of £13,000 5 per cent. debentures created January 25th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue (at 90 %) being £7,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Cowper-Coles Copper Corporation, Ltd. (89,493).—This company's annual return was filed on January 5th, when the entire capital of £1,750, in 1s. shares, had been taken up; 7s. has been received, and £1,749 13s. is considered as paid. Mortgages and charges: £5,000 debentures.

Turbine Corporation, Ltd. (93,753).—This company's annual return was filed on January 21st, when 117,007 shares had been taken up out of a nominal capital of £150,000, in £1 shares; £7 has been received, and £117,000 is considered as paid. Mortgages and charges: Nil.

Whirley Switch Car Syndicate, Ltd. (91,134).—Debenture dated January 20th, 1909, to secure £65, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: G. Aston & Son, 46, Eagle Road, New North Road, N.

National Telephone Co., Ltd. (15,066).—Trust deed dated January 14th, 1909 (supplemental to deeds dated December 30th, 1899, October 8th, 1900, October 21st, 1901, and March 3rd, 1904, securing £450,000 4 per cent. debenture stock). Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Sir Mitchell Mitchell-Thomson, Bt., Charlotte Square, Edinburgh; and Sir Frank Forbes Adam, Kt., Nore Old Hall, Knutsford, Chester.

Cowper-Coles Inventions Development Co., Ltd. (65,755).—This company's annual return was filed on January 14th, when 1,582 "A" and 10,000 "B" shares had been taken up out of a nominal capital of £50 000 in 25,000 "A" and 25,000 "B" shares of £1 each. £1,582 has been received and £10,000 is considered as paid. Mortgages and charges: £300 debentures.

New St. Helens and District Tramways Co., Ltd. (59,426).—This company's annual return was filed on November 25th, when 15,960 preference and 9,000 ordinary shares had been taken up out of a nominal capital of £150,000 in 20,000 preference and 10,000 ordinary shares of £5 each. £5 per share has been called up on 24,980 shares, resulting in the receipt of £125,410, including £510 paid on 1,020 shares forfeited. Mortgages and charges: nil.

Llandrindod Wells Electric Light and Power Co., Ltd. (48,340).—Memoranda of satisfaction in full (*a*) of debenture and collateral mortgage dated March 22nd, 1902, securing £8,700, and (*b*) of debenture and collateral mortgage dated July 10th, 1905, securing £4,000, have been filed.

Particulars of £14,700 debentures created January 23rd, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being issued on same date. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Uxbridge and District Electric Supply Co., Ltd. (62,706).—Particulars of £35,000 debentures created July 14th, 1904, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Underground Electric Railways Co. of London, Ltd.

The directors' report to December 31st, 1908, says that the revenue account shows, after payment of interest on the 4½ per cent. bonds of 1933, a deficit of £11,837. To cover this deficit, Messrs. Speyer have paid to the company, in accordance with the agreement of April 7th, 1908, £12,000, in respect of which there has been issued to them £8,000 4½ per cent. bonds, and £12,000 6 per cent. income bonds. The traffic and receipts of the railways in which the company is interested, continue to show satisfactory increases, and summaries of these are given in the report.

It is stated that the accounts of the London United Tramways, Ltd., for the year ending December 31st, 1908, have not yet been published. That company have paid on account of the 5 per cent. cumulative preference shares dividends at the rate of 5 per cent. per annum for the first half and 2½ per cent. per annum for the second half of the year 1908, making 3¾ per cent. for the year. Although there has been an increase in the total traffic receipts, the receipts have not shown that expansion which had been anticipated having regard to the additional route mileage worked. The company has had to encounter severe competition, which has seriously interfered with the growth of traffic on the main routes. The directors of the tramways company felt that in view of the necessity for providing funds to meet future renewals, the strengthening of the reserve funds, which they had hoped would have been possible out of increased receipts, should in the permanent interests of that company be no longer delayed, and that for the present the payments on account of preference dividend should be limited to 2½ per cent. per annum.

Electric power continues to be furnished to the Metropolitan District, the Baker Street and Waterloo, the Great Northern, Piccadilly and Brompton, and the Charing Cross, Euston and Hampstead Railway Companies, as well as to a section of the London United Tramways. The net output of electric energy from the power house during the half-year was 57,313,700 KW.-hours.

Since the close of the year the secured loans, which appear in the balance-sheet at £809,450, have been reduced to £509,450; part of the company's holding in Debenture stock of the Great Northern, Piccadilly and Brompton Railway Co. having been sold for the purpose.

Metropolitan District Railway Co.

Sir George Gibb presided at the half-yearly meeting on 10th inst., and moved the adoption of the report (see Electrical Review, February 5th, page 226). He said that they had had dark days, but things were now improving. The more they studied the accounts, the more confidence they would have that the improvement in their financial position had a sound and enduring foundation. The revenue account had many bright and encouraging features. The gross revenue amounted to £261,874, an increase of £37,411, or 16·67 per cent. The working expenses were £153,868, a decrease of £2,201. The ratio of expenses to receipts was now 58·76 per cent., as compared with 69·53 per cent. in the corresponding half of last year. They had carried 31,503,722 passengers, being an increase of 5,694,990, or 22 per cent. The passenger earnings had been £243,117, an increase of £38,235, or 18½ per cent. This was the highest figure for passenger earnings which the company had ever had. The season ticket revenue had amounted to £22,043, an increase of £8,691. Until now this revenue showed an almost continuous decline since the year 1899. The increase in it showed the increasing popularity of the railway. The Franco-British Exhibition brought multitudes of visitors to London from all parts of the country. What they might lose by a falling off in the special exhibition traffic would, he thought, be replaced by the normal increase in traffic. One very encouraging feature was that the increases occurred at nearly every station on the line. Their endeavour had been, and would continue to be, to develop their traffic and revenue by increasing the train service, and during the last half-year the passenger train-mileage showed an increase of 24·12 per cent. The car mileage showed a less increase, but the car-mile figure showed that the additional service had been justified, for the car-mile

receipts in the half-year were 9·52d., as compared with 9·45d. In regard to the expenditure the electric train-working again showed a decrease of £6,247, which was explained by the smaller expenditure incurred, or rather the credit on expenditure in connection with the Tilbury working. They had had some saving from the introduction of the hand-worked door in substitution for the air-worked door. That work was proceeding, and nearly the whole of the stock was altered, and he was very glad of it. They would not only get some saving from this alteration, but also increased safety. Then they had had during the half-year a very substantial reduction in the price of electric current supplied from Chelsea. That generating station was working most excellently, and this year they had benefited by the improvement in working and also by the reduction in the price of coal. The business of carrying passengers in London was beyond all question in an unsatisfactory condition. Capital did not get a fair return. Every company engaged in the business supported by private capital was suffering. This was not surprising, so far as railways were concerned, when they considered that the average receipt per passenger carried by the nine urban railways in London only ranged between 1·45d. on the North London, which was the lowest, and 2·03d. on the Central London, which was the highest of the group. Some years ago some people, who had the initiation of policy, thought that the encouragement of traffic by very low fares was the way to prosperity. It had proved to be the way to misfortune. In September, 1906, they increased their fares slightly. His belief was that since then their traffic had increased nearly as much as it would have done at the old level of fares. Their average receipt per passenger in the last half-year was ·18d. higher than in the half-year preceding the increase. That trifling addition per passenger gave them in the last half-year the substantial sum of nearly £24,000. But if they asked them to make further increases, he must frankly tell them that he did not think the time was opportune. He thought that more co-operation amongst the various competing interests would, even in presence of the depressing effect of municipal competition, do a great deal to improve the situation.

The report was adopted.

Crossley Bros., Ltd.

The directors in their report for the year ending December 31st, 1908, regret that owing to abnormal trade depression, the results are not as satisfactory as in past years. The amount at disposal is £77,524, out of which a dividend has been paid on the preference shares at the rate of 5 per cent. per annum, and a dividend on the ordinary shares at the rate of 5 per cent. per annum to June 30th, 1908, amounting to £24,342, thus leaving a sum of £53,181 for present disposal. Out of this the directors propose to pay a further dividend for the second half of the year at the rate of 5 per cent. per annum on the preference shares, and 3 per cent. per annum on the ordinary shares (making 4 per cent. for the year), and leaving a balance of £34,542 to the next account. Owing to the strain of Parliamentary life, and feeling that the time has arrived when he might reasonably seek relief from the cares of business, Mr. Crossley has decided to relinquish his position as chairman from the beginning of the year, though he retains his seat on the board. Having regard to the large holding that his family has in the concern, the board has agreed to Mr. Kenneth Crossley replacing his father as chairman.

National Telephone Co., Ltd.

The report of the directors for the half-year ending December 31st, 1908, says that the income accrued in respect of the business amounts to £1,498,432, as compared with £1,387,190 for the corresponding period of 1907, being an increase of £111,242. The working expenses for the half-year amount to £858,566, as compared with £780,333 for the corresponding period of 1907, being an increase of £78,233. The net result for the half-year (after deducting the Post Office royalties amounting to £144,227) is a profit balance of £495,639, as compared with £474,236 for the corresponding period of 1907, being an increase of £21,403. The rentals carried forward for unexpired terms of running contracts amount to £1,245,351, compared with £1,168,389 at the corresponding period of 1907, being an increase of £76,961. Out of the available balance of £384,089 shown by the net revenue account (No. 3), the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £155,000 to the reserve fund account, and to carry forward the balance of £10,339. The sum of £361,079 4s. 3d. has been expended on capital account during the half-year in the erection of 12,030 additional exchange and private stations and in the construction of underground works.

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit, the directors recommend a dividend on the ordinary shares at the rate of 15 per cent., free of income-tax, including the interim dividend of 5 per cent. paid September 1st last. Last year the distribution was at the same rate.

Mather & Platt, Ltd.—The report for the year ended December 31st, 1908, states that the net profits, after charging depreciation and making provision for directors' remuneration and expenses, are £139,454, to which must be added the balance brought forward, making an available total of £155,511. After paying 5 per cent. on the preference shares, and 10 per cent. plus a bonus of 7½ per cent. on the ordinary and transferring to reserve account (bringing up the amount to £375,000) £35,000, there is carried forward £30,511.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Indian Electric Supply and Traction Co., Ltd.—25,000 shares of £5 each, fully paid, Nos. 1,008 to 26,007, in lieu of the £125,000 6 per cent. construction debenture stock now quoted, together with 1,007 additional shares of £5 each, fully paid, Nos. 1 to 1,007.

Singapore Electric Tramways, Ltd.—£350,000 5 per cent. debentures of £100 each, Nos. 1 to 3,500 (registered).

United Electric Tramways of Monte Video, Ltd.—Further issue of 6,500 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 42,065 to 42,564 and 70,501 to 76,500; and £200,0.0 5 per cent. first debenture stock.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—12,500 5 per cent. cumulative preference shares of £10 each, fully paid.

And to allow the following securities to be quoted in the Official List:—

Telegraph Construction and Maintenance Co., Ltd.—£150,000 4 per cent. debentures, Nos. 1 to 1,500 of £100 each, in lieu of the debentures due January 1st, 1909.

Bristol Tramways and Carriage Co., Ltd.—In presiding at the meeting held at Bristol, on the 10th inst., Sir Geo. White said that the tramway returns showed an increase of £2,413. The actual working expenses were as near as possible to those of 1907; if anything, there was a small decrease, while the total receipts of the company were approximately the same. But for the reconstruction of permanent way (£9,876) the net revenue would have been about the same as in the previous year; it reduced the balance to £74,780. It was unpleasant to accept a lower dividend, but it was a sound and proper course to adopt. The report (see Electrical Review, February 12th, page 270) was adopted.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The report for the year ended January 31st states that the profits, after deducting administration and other expenses, amount to £8,935; £1,277, representing the preliminary and formation expenses of the company, has been written off, and £2,000 has been put to a general reserve account for depreciation and other purposes, leaving £5,659, which, with the amount brought forward, makes a total of £5,884. The dividend is at the rate of 7 per cent. for the year, carrying forward £913.

City of Buenos Ayres Tramways Co. (1904), Ltd.—Mr. E. H. Woods, presiding over the meeting of this company held last week at Winchester House, remarked that the available balance after payment of the interim dividends for the nine months ended September 30th was £18,948. There had been set aside for the general amortisation fund £3,300, increasing it to £21,296; the debenture stock amortisation fund was £13,167. Their prosperity was bound up with that of the Anglo-Argentine Co., which was experiencing continued prosperity.

Prospectuses. — *Lanarkshire Tramways Co.*— The directors are making an issue of 3,500 shares of £10 each, at par, for the construction of extensions referred to in the report appearing on another page.

Paramaribo Rubber and Timber Estates, Ltd.—This company has been offering for subscription 40,000 shares of £1 each. It will acquire rubber estates in Surinam, in Dutch Guiana.

Waste Heat and Gas Electrical Generating Stations, Ltd.—This company, whose report is referred to above, is offering for subscription a further issue of 65,000 shares of £1 each.

Winnipeg Electric Railway Co.—This company is inviting subscriptions until to-morrow, Saturday, for £300,000 4½ per cent. perpetual consolidated debenture stock.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors report that, for the last 12 months, after providing for all expenses, including repairs and renewals, there was a net income of £27,875, plus £8,509 brought forward, making the available profit £36,385. Debenture interest on 4½ per cent. stock required £11,756; debenture interest on 6 per cent. bonds, £1,624; sundry reserves, £9,343; leaving to be carried forward, £13,661. The passengers carried were 9,056,132 and the miles run 1,803,015.

Victoria Falls Power Co.—A Berlin dispatch to the *Financial News* says that the parcels of this company's debentures in the hands of the different syndicates originally amounted to £625,000, but they have diminished to a very great extent recently, and it is probable that the syndicates will be dissolved shortly.

Buenos Ayres Grand National Tramways Co., Ltd.—A meeting has been called to ratify a provisional agreement for the sale of the property and undertaking to the Anglo-Argentine Tramways Co, Ltd. The terms appear in the *Financial Times* of February 10th.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from February 16th to March 1st.

Charing Cross, Euston and Hampstead Railway Co.

The directors' report, submitted at yesterday's meeting, says that the traffic shows a steady, progressive and most satisfactory increase, occurring at every station on the railway, and being most marked in the through traffic exchanged with other railways. The gross receipts on revenue account amount to £94,067, being an increase of £19,738, or 26·55 per cent. on the receipts for the corresponding half of 1907. The working expenses amount to £57,242, being a decrease of £4,111, or 6·70 per cent. The net revenue of £37,941 is sufficient to provide for interest on the total amount authorised to be raised by debenture stock, and after payment of all interest and other charges on net revenue account there remains a credit balance of £6,102, which is to be carried forward. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year, Dec., 1908.	Half-year, Dec., 1907.	Inc. or dec.	Per cent.
Maintenance of way and works	£5,940	£3,868	+£2,072	+76·87
Repairs and renewals of rolling stock ..	2,753	2,585	+ 168	+ 6·50
Lift expenses..	5,089	5,866	— 827	—14·09
Train working and traffic expenses ..	36,406	43,390	— 6,984	—16·10
Other items	2,291	1,942	+ 350	+18·02
	£52,480	£57,151	—£4,721	— 8·26
Rates and taxes	4,812	4,203	609	+14·49
Total	£57,242	£61,354	—£4,112	— 6·70

The following table gives a summary of comparative statistics for the second halves of the years 1907 and 1908:—

	Half-year Dec., 1908.	Half-year Dec., 1907.	Increase or decrease.	Per cent.
Passengers, including workmen and season ticket-holders' journeys ..	13,015,363	9,881,357	+3,134,006	+31·72
Passengers carried at workmen's fares	2,356,819	1,803,553	+ 553,266	+30·67
Passenger receipts	£89,717	£70,272	+ £19,445	+27·67
Average receipt per passenger ..	1·65d.	1·71d.	— ·06d.	—3·51
Train mileage	818,058	883,036	— 64,978	—7·36
Car-mileage..	2,626,055	2,880,715	— 254,660	—8·84

Great Northern, Piccadilly and Brompton Railway Co.

The directors report that the capital expenditure during the half-year amounted to £43,000. The gross receipts on revenue account amounted to £143,235, being an increase of £23,964, or 20·09 per cent. on the receipts for the corresponding half of 1907. The working expenses amount to £72,469, being an increase of £1,716, or 2·43 per cent. After providing for interest and other items on net revenue account, and for dividend at the rate of 4 per cent. per annum on the amounts paid up on the preference shares, there remains a balance of £23,448 available for dividend on the ordinary shares, and the directors recommend that a dividend at the rate of ¾ per cent. per annum be declared on the amount paid up on the ordinary shares, leaving a balance of £5,860 to be carried forward. The dividends are payable on February 20th.

The following table gives a summary of the working expenditure in comparison with the corresponding period of last year.

	Half-year, Dec., 1908.	Half-year, Dec., 1907.	Inc. or dec.	Per cent.
Maintenance of way and works ..	£6,391	£4,501	+£1,890	+41·99
Repairs and renewals of rolling stock	4,089	3,516	+ 573	+16·30
Lift expenses	7,069	7,342	— 273	— 3·72
Train working and traffic expenses ..	42,411	45,429	— 3,018	— 6·64
Other items	4,840	2,820	+ 2,020	+71·63
	£64,800	£63,608	£1,192	+ 1·88
Rates and taxes	7,669	7,145	524	+ 7·33
Total	£72,469	£70,753	£1,716	+ 2·43

The following table gives a summary of comparative statistics for the second halves of the years 1907 and 1908:—

	Half-year, Dec., 1908.	Half-year, Dec., 1907.	Inc. or dec.	Per cent.
Passengers, including workmen and season ticket-holders' journeys	16,990,501	13,914,779	+3,075,722	+22·10
Passengers carried at workmen's fares	1,994,342	1,820,418	+ 173,924	+ 9·55
Passenger receipts	£137,256	£115 008	+ £22,248	+19·35
Average receipt per passenger	1·94d.	1·98d.	— ·04d.	— 2·02
Train-mileage	1,147,388	952,571	+ 194,817	+20·45
Car-mileage	3,565,358	3,206,269	+ 359,069	+11·20

The meeting was held yesterday.

Tyneside Tramways and Tramroads Co.

The directors' report for the half-year ending December 31st, 1908, shows that the surplus of receipts over expenses is £3,204, which, with £728 brought forward, makes a total of £3,932, and after deducting interest on debentures, loans, &c., amounting to £1,140, there remains an available balance of £2 792, which is to be appropriated as follows:—Preference dividend 5 per cent. £545, dividend on ordinary shares at the rate of 1½ per cent. per annum (as compared with 2½ per cent. for the corresponding half-year of 1907) absorbing £1,004 placing to reserve for renewals, depreciation, and other contingencies (increasing the amount to £6,100) £600, and carrying forward £642. The decreased profit is entirely consequent upon the reduction in receipts amounting to £887, against which the reduction in running expenses is only £305. This falling off of revenue is attributable to the smaller traffic on the company's lines caused by labour troubles and depression in trade, which have been prevalent in the district during the greater part of the period. The whole of the track, overhead line, and rolling stock has been kept in thorough repair during the past year out of revenue. Of the unissued preference shares, 192 were applied for and allotted during the half-year, levying 748 still unissued. Lord Armstrong, owing to his spending part of his time abroad, has considered it necessary to resign his position as Chairman, and Dr. J. T. Merz has been elected in his place.

Comparative Statement.

	1907.	1908.
Car-miles (Tyneside Tramway Co.'s cars) ..	679,692	675,894
Passengers carried (Tyneside Tramway Co.'s lines	4,703,459	4,143,625
Total traffic receipts	£24,068	£21,930
Gross profit	£8,262	£6,474

Dr. J. T. Merz presided at the meeting at Newcastle on 9th inst. He said that the traffic receipts for the 12 months amounted to £21,930, as compared with £24,068, a decrease of £2,138, or 9 per cent.; of the latter sum £489 represented losses on holiday traffic, and £1,649 had been lost on ordinary traffic. Passengers had decreased from 4 703,459 to 4,143,625, a reduction of 560,034. Their expenses had been £323 less. The cost per car-mile was 5·7d., against 5·8d. in 1907. The traffic receipts were 7·79d., as against 8·49d. per car-mile in 1907. In consequence of the large reduction in the traffic receipts, the profit for the year had been reduced from £8,261 to £6,446, a reduction of £1,815, which compared with an increase of £469 for 1907. They had increased the reserve by £1,500 during the year, and had written off £330 from the preliminary expenses. The loans, which in 1907 stood at £9,781, had been reduced to £6,000, and this reduction had been effected by the issue of 219 preference shares, through writing off £1,500 and £330 of the gross profits. It was well known what had been the causes of the reduction in the receipts, and the best news he had was that at the end of the year the traffic receipts again came up to the level of the year before, and that at the present time the receipts were much better than they were last year. As soon as the ferry service stopped on the River Tyne the receipts of the company went up by about £10 a week. But they did not anticipate that if the ferries were re-started, of which there was a distant prospect, they would lose all that increase, for some of the workmen who used to cross the river were finding it more convenient to live at Wallsend, on the north side. There was a considerable demand for workmen's houses in Wallsend, and if they once settled there and found it convenient, they were not likely again to make use of the river ferries. The dividend they were able to declare was at the rate of 1½ per cent. for the half-year, which was equivalent to ¾ per cent. for the whole year, as they paid no dividend for the first half-year.

Mr. G. E. Henderson seconded the adoption of the report, which was carried.

The dividends were formally carried, and the directors and auditor re-appointed.

London Electric Supply Corporation, Ltd.

The ordinary general meeting of the shareholders of this company was held on Tuesday last week, at Winchester House, Old Broad Street, the Earl of Crawford presiding.

Mr. Robert H. Benson, in proposing the adoption of the report (see Electrical Review, February 5th, page 226), said that that ought to be the pleasantest meeting that had ever been held in connection with the company. They had been fighting for the past four years in Parliament for their birthright, and had won. Before touching upon their own company in particular, he thought it would be interesting if he gave a brief summary of the history of the electrical industry in London. Parliament parcelled out London between 13 private companies, and gave them till 1931 to make what they could within limits, out of the industry of purveying current for light and power. They were forbidden to amalgamate or to associate together, and it was imagined that competition would regulate the price and give cheap electricity to the consumer. It did not, however, because Parliament by ordaining that electricity should be produced in 13 different isolated areas caused most generating stations to be established in costly and uneconomical places in the midst of London. The fact was overlooked by Parliament that electricity could be produced cheapest if production were centralised on the Thames, where coal was cheap, and if it were in the hands of one or two companies, instead of 13, and that science would gradually enable it to be transformed cheaply in all directions. Ten years ago there was no demand for power only for light. Five years ago the public woke up to the fact that we were behind other nations, and an agitation arose for cheap power for the salvation of British industries. Many power companies were started in different parts of the country, but the only one that was at all successful was that at Newcastle, and a Bill was promoted called the Administrative County of London Bill, to supply wholesale the existing companies and municipal authorities, as well as railways and other big consumers. The existing companies, like this, would have lost their Parliamentary birthright, and have been frozen out, and it was by the merest accident that that Bill did not get its third reading. Looking back it was clear that that proposed power company would have been another financial failure, and that section of the public who were to put from 5 to 10 millions sterling into it had had a lucky escape, but so tempting did the prize appear to various

promoters, that each session since then had witnessed the introduction of new power Bills, and the companies and the municipal authorities who were already in the field, and had invested some 20 millions sterling in the industry, were put to great cost each year to defend their position. Just about £500,000 had been spent in that Parliamentary fight and wasted. The last of the Bills was actually passed last July by the Committee of the House of Lords, which was supposed to be tender of vested interests and private enterprise, but in the Autumn Session a Parliamentary Committee of the Commons took a strong line and rejected the Bill, and then passed another Bill to utilise the existing plant for all it was worth, and enable the companies that were already in the field to associate for common economy and the public benefit. They also settled the probable destiny of the companies in 1931, by transferring the option of purchase from the borough councils to the L.C.C. The half-a-million of money thus wasted was the lesser part of the damage done. The damage to the credit of the electrical industry might be measured by the fall in the quotations of the shares of the seven principal London companies. Taking the ordinary stocks of these seven companies, the depreciation in the four years' fight had been 48 per cent., or from £6,371,000 to £3,306,000, and it had been difficult for them to maintain enough credit to raise the necessary capital to meet the legitimate expansion of the demand for light and power. In regard to the Newcastle company, upon whose experience the promoters were promising power at from 1½d. to 1d. per unit, or even, under certain load factors, ½d. per unit, its shares were, four years ago, equal to 160 per cent.; now they were at 50 per cent. The fight was now over, and the principle was recognised that centralised production in the hands of existing producers, was the cheapest, and it remained for the companies to profit by the permission given to associate together. It was not yet possible to say precisely how that would work out. Mutual interests had to be found and defined. Probably those generating stations which were most economically situated would be developed and those which were least economical would tend to become substations. As to their own station at Deptford, by common consent that was one of the most economical. They would remember that when Mr. Merz was planning the central generation station for his company, he proposed to put it on the river, a little lower down than theirs, thus proving the economical advantage of the Deptford location. The next, and even more important point in their improved position, was that it had fallen to their lot to be the first purveyors of power to one of the great English railway companies—the Brighton line. Their plant for that purpose was complete, and the company were already taking current for experimental running of trains, and they expected to be in operation before July 1st, from which date the contract started. The minimum number of units for that particular service of trains was 4,000,000, but that might not be all. It seemed that the only way in which railways could meet the competition of electric tramways was by electrifying their services, and if the Brighton Co. were to electrify all their suburban lines, they would be happy to supply them with 40,000,000 units, instead of 4,000,000. Other companies were closely watching the results of the Brighton experiment. They were the pioneers of the alternating current. While other companies adopted direct current, the bulk of their plant supplied alternating current, and it was single-phase alternating current that the Brighton Co. required. They anticipated in the course of the next two or three years a great expansion in the demand for alternating current, which was just what they supplied. Another point was the introduction of metallic-filament lamps which worked best with the alternating current. In 1904-5 they received exceptional receipts from the L.C.C., which they put to reserve, and allowing for that, the progress of the company had been continuous. The lighting business had increased 38 per cent. between 1903 and 1908, and the power business—other than the current supplied to the L.C.C., had increased 1,274 per cent. The cost per unit sold had gone down from 2¼d. to ·63d., and the total costs, including distribution rates, &c., from a little over 3d. to 1·9d. For some years they had had the very friendliest business relations with the L.C.C., having acted as a stand-by for the supply of current to their tramways, and it would appear that such mutual arrangements were an insurance against breakdown. Comparing 1908 with 1907, the net revenue was £7,000 greater. They proposed to pay 3 per cent. dividend on the ordinary shares, against 2½ per cent.; to put £5,000 to reserve against £2,500, and to carry forward £3,408 against £2,836 brought in. The reserve and contingency accounts together now amounted to £72,500, or 21·77 per cent. of their ordinary share capital of £333,000. The accounts of last year had had to bear the cost of the plant for the Brighton Railway, but the revenue had not received the benefit thereof. As to the possibility of further economies in generating costs, they all knew that the secret of cheap power was a good load factor, and that could only be accomplished by large consumers together, so that when one did not require it the other was taking it. The demand for light averaged less than four continuous hours, and thus employed less than one-sixth of their total capacity. The demand of an ordinary manufacturer was less than a 25 per cent. load factor. The most valuable customer was one who would take a uniform quantity for 24 continuous hours, and there was room in the future for dovetailing the various demands of customers, so as to secure the highest load factor and the cheapest production. The position of the company now was sounder than it had ever been. He dared say after all the storms they had weathered, that the shareholders could hardly believe it, but whenever they did the company's credit would improve. It was easy to pull down and so difficult to build up, but nevertheless, he looked to see the credit of the whole industry improved. No consumer, however much he might agitate for cheap power, wanted to ruin the producer. Fortunately Parliament had recognised this fact and had drawn a line. The idea was exploded that cheap power could be obtained by Act of Parliament, and that if the companies paid big dividends it meant dear power and the consumers' loss. He hoped and thought that by the Act passed last Session, the policy of taking care of the consumer at the expense of the producer was abandoned in the electrical industry once and for all, and that they would henceforth be free to make dividends until 1931, and then hand over a group of prosperous undertakings to the London County Council without any loss of capital being inflicted on the shareholders.

Mr. R. Stewart Bain (managing director) seconded the motion, and remarked that the fact of their having sold 3,000,000 more units at an additional cost of only £688, spoke very highly for the efficiency of the engineering and other departments. They expected ultimately to benefit from the introduction of the metallic-filament lamp by an increase in their consumers.

The report was adopted.

Baker Street and Waterloo Railway Co.

The directors' report for the half-year ending December 31st, 1908, which was submitted at yesterday's meeting, states that the revenue continues to increase satisfactorily. The gross receipts on revenue account amount to £86,355, being an increase of £17,106, or 24·70 per cent., on the receipts for the corresponding half of 1907. The working expenses amount to £44,663, being an increase of £737, or 1·68 per cent. After providing for interest and rents, and for dividend at the rate of 4 per cent. per annum on the preference shares, there remains a balance of £12,082 available for dividend on the ordinary shares, and the directors recommend that a dividend at the rate of ¾ per cent. per annum be declared on the ordinary shares, and an additional dividend at the rate of 2¼ per cent per annum (making 3 per cent. per annum in all) on the ordinary shares other than those held by the Underground Co. or their nominees, leaving a balance of £2,247 to be carried forward. The dividends are payable on February 20th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year, Dec., 1908.	Half-year, Dec., 1907.	Inc. or dec.	Per cent.
Maintenance of way and works ..	£1,230	£2,320	+£1,910	+82·33
Repairs and renewals of rolling stock	4,123	2,793	+ 1,330	+47·62
Lift expenses	4,440	4,192	+ 248	+ 5·92
Train working and traffic expenses ..	24,803	27,834	— 3,032	—10·89
Other items	2,719	2,562	+ 157	+ 6·13
	£40,314	£39,701	+ £613	+ 1·54
Rates and taxes	4,349	4,224	+ 125	+ 2·96
Total	£44,663	£43,925	+ £738	+ 1·68

The following table gives a summary of comparative statistics for the second halves of the years 1907 and 1908:—

	Half-year, Dec., 1908.	Half-year, Dec., 1907.	Inc. or dec.	Per cent.
Passengers, including workmen and season ticket-holders' journeys	13,337,126	10,662,876	+2,674,250	+25·08
Passengers at workmen's fares ..	1,782,644	1,622,298	+ 160,346	+ 9·88
Passenger receipts	£82 493	£66,536	+ £15,957	+23 98
Average receipt per passenger ..	1·48d.	1·50d.	— ·02d.	— 1·33
Train-mileage	594,281	523,239	+ 71,142	+13·60
Car-mileage	1,819,289	1,633,106	+ 185,833	+11·38

A Bill is being promoted in Parliament seeking powers to extend for two years from August 4th, 1911, the time for constructing the authorised extension to Paddington, and to purchase certain property adjoining Oxford Circus Station for the purpose of enlarging that station in order to provide more accommodation for the increasing traffic. The Bill also seeks power to abandon certain authorised subway works under Trafalgar Square.

A Bill has been deposited in Parliament by the N.-W. London Railway Co. seeking power to abandon the portion of their authorised railway between Edgware Road and Victoria, and to join their author sed line from Brondesbury to Edgware Road with this company's railway at Edgware Road station, so that the two railways may be worked as one continuous line. An agreement providing for the management, maintenance and working by this company of the N.-W. London Railway, when constructed by the N.-W. London Co. between Edgware Road and Brondesbury, is under negotiation, and, if terms are arranged, will be submitted to the proprietors for approval at a special meeting.

Dublin United Tramways Co. (1896), Ltd.

Mr. W. M. Murphy presided at the half-yearly meeting held at Dublin on February 2nd, and in moving the adoption of the report, he said that it was satisfactory to find that the earning powers of the tramway in a normal year were sufficient not only to maintain the usual rate of dividend, but to meet exceptionally large demands for renewals of track. The steady growth of the parcels traffic continued. A good business might be done with mineral and goods traffic. The total cost of generation—viz., £9,053, was a good deal in excess of any previous half-year, except the corresponding half-year of 1907, when the cars ran 300,000 miles more than in 1908. This was due to the increased consumption of electric current per car-mile, which still continues. Their electrical engineer, Mr. Sheardown, had for some time back been investigating this apparent phenomenon, and he was glad to say that he had been able to eliminate from his calculations as a probable cause of loss in electric current, any deterioration in the efficiency of the electric installation. He had, in fact, been able to locate the cause of the increased consumption of electric current by attaching wattmeters to a selected number of cars of different types working under different conditions. The result of the tests showed that where cars were running under conditions similar as to weight, speed, stops, &c., to when they were first started some years ago, there was little or no change in the power required to drive them, but where heavier cars had been

introduced, driven at higher speeds and stopping frequently, the consumption was in many cases double the old rate, which tended to raise the average. They thought that this tendency to increase electric current consumption could be in some measure checked by attaching wattmeters to all the cars so that the drivers and inspectors could see how their cars were working, and they were making provision for them. The electric current bill could be materially diminished if the cars did not stop so frequently, and a good many of the stops now made might be avoided. In this connection the manager proposed shortly to inaugurate an express service to Dalkey, morning and evening, to suit business people. The cars now stop once every 50 seconds on an average between Nelson Pillar and Dalkey, so a substantial saving in time could be effected without exceeding the speed authorised by the Board of Trade. The cost of producing current—viz., 377 of a penny per unit, was as low as ever, having regard to the comparative prices of coal, and they expected to purchase coal at a lower price again when the present contract expired next April. Notwithstanding the increase on the average of electricity consumed by each car, the average cost for propelling and lighting a car while it travelled 1 mile was only ·559 of a penny, or less than three-fifths of a penny per mile. Under the head of maintenance there is, compared with 1907, a saving of about £794 in car bodies and trucks, and £615 in car electrical equipment, but there was an increase of £270 in boilers; this included the cost of installing a new and improved form of mechanical stoker on one of the boilers to replace the type with which they were originally equipped, and which were the best appliances of the kind on the market when they were installed. They had found that the new stoker effected a substantial saving in coal, which paid its cost in a very short time, and they had decided to provide them for all the boilers. In addition to the ordinary maintenance of the company's property, two exceptional works were executed during the half-year, the whole costs of which are charged against revenue. One of these works was the relaying of the Blackrock line, upon which £13,521 was expended. Towards this expenditure a sum of £4,749 had been brought forward, leaving £8,772 on this account charged against the revenue of the half-year. The relaying of this line had now been completed from Haddington Road to Temple Hill, beyond Blackrock, at a cost of £29,170, all charged to revenue. They had previously expended £8,365 out of revenue in electrically welding the rails, which prolonged their life for a few years. They had now a splendid road laid with 105 lb. rails, good for 30 years, replacing 70 lb. rails, which had given out in 12 years. There was another item of £836 charged against the profits. The two tall chimneys at Ringsend power house were built of steel, at a capital cost of less than one-third that of brick chimneys. Steel exposed to the weather and to the fumes of chemical works would not last for ever, and they were taking the precaution of making them secure for an indefinite time by an internal lining of ferro-concrete, at a cost of £1,200 per chimney. One of them had been completed, and after making tests as to its efficiency, they would proceed with the other. They were paying the usual 6 per cent. dividend on both classes of capital. They were asking for the capital powers to be increased by £100,000, in order to be in a position to raise money if needed. It was not needed at present, but would be raised a little at a time only as actually required.

The report was adopted, after discussion, and the resolution increasing the capital by 10,000 ordinary shares of £10 each was unanimously agreed to at a subsequent extraordinary general meeting.

St. James's and Pall Mall Electric Light Co., Ltd.

Mr. Walter Leaf presided on Tuesday at the offices, Carnaby Street, over the ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, February 12th, page 269), the Chairman said he hoped it would give as much satisfaction to the shareholders as it did to the board that they were able to meet at the end of a year which had generally been one of commercial depression with a statement showing marked improvement on the revenue and profits. Their net revenue amounted to £34,716 as against £32,278 for the preceding year, whilst they had in addition on 5 per cent., or £2,500 received on their shares in the Central Electric Co. for 1907. He might say that a similar dividend had been declared by that company for 1908, and this would come into their next year's account. This improvement had been brought about by various causes. In the first place, the efficiency of the Grove Road Works of the Central Electric Supply Co. had been materially improved by the erection of condensing plant in connection with low pressure turbines for the proper utilisation of the waste steam from the main engines, and by the addition of three large Babcock boilers with special furnaces and automatic stokers, which enabled a cheaper grade of fuel to be used to the best advantage. They had also had the advantage of the fall in the price of coal. These causes had reduced the cost of the unit taken from Grove Road by about 10 per cent., though the new plant had only been in work for a part of the year. They had thus been enabled to take over a million more units from the Central Co. with a material saving of cost, and for the first time the units taken from the bulk station exceeded those generated at Carnaby Street and Mason Yard. They were also glad to report a steady increase in the connections to their mains. They had risen by 800 kw. or just 7 per cent.—rather less than in 1907, but slightly better than the average increase for some years past. Their revenue had also risen though in less proportion, from £116,925 to £120,117, or rather less than 3 per cent., while the price obtained per unit sold had fallen from 3·109d. to 3·026d. This result was due partly to an increase in the number of units sold for power purposes at the flat rate of 1d., which now represented 13½ per cent. of the total output, as against 10¾ per cent. last year, and also to the fact that the number of units sold for lighting purposes had not increased in a similar proportion to the number of new connections. It was in this way that they were feeling the steady increase in the use of metallic-filament lamps, about which he spoke at length last year. In fact, the increase in the demand for electricity for lighting purposes was counteracted by the diminution in the consumption caused by the higher efficiency of these lamps. It was satisfactory to know that they had so far an increased revenue from electricity sold for lighting purposes in spite of this economy, but how far it might affect them in the immediate future was at the present moment particularly difficult to say. The improvement of the metallic-filament lamp was proceeding, and the substitution of new lamps for old would undoubtedly continue, possibly at such a rate as to cause for a time an actual falling off in the revenue. He thought, however, that any cheapening in the cost to the public would in the long run benefit the industry, though it might cause a temporary loss. Meanwhile, with this possibility before them, it was quite clear that they should not increase the dividend on the shares, but must devote their additional profits to a reserve which might help to tide over any bad time. They had, therefore, carried £3,500 to their special contingency fund, and proposed to increase the amount carried forward by some £1,500, and with this prudent policy they confidently reckoned on the support of the shareholders. The addition to capital account of £5,075 under the head of machinery and fixed plant was due to the installation of two large motor-generators at the Carnaby Street works in order to enable them to take further advantage of the high-voltage supply from Grove Road. The addition to the cost of the artesian well arose from the erection of fresh pumping plant, as that originally installed was not entirely efficient. The last item on the capital account, the addition of £2,401, under the head of Parliamentary and legal expenses, brought before them what was the most satisfactory event of the past year for the electrical industry of London. It was their share of the costs of obtaining the Act which, as they confidently hoped, meant an end, at all events for a long time to come, of the harassing Parliamentary fights to which the London companies had for the past four years been subjected. They had spent more than that amount in the past in endeavouring to defend their interests and had charged the cost to revenue as they had no tangible result to show for their efforts. They had now, however, obtained substantially the object for which they were fighting, and in their opinion this meant such an addition to the value of the property as justified them, with the full approval of the auditors, in adding the amount to capital. The Chairman proceeded to deal with the Bill which the company, in combination with the Westminster, Kensington and Knightsbridge and Notting Hill Cos. promoted, which he said would not only enable them to link up with these companies, but with every other company and municipality supplying in London. The only material obligation imposed on them was not to oppose any Bill in Parliament when the time came for the purchase of the undertaking by the London County Council instead of the Westminster City Council. Although they must not oppose on the main point, they reserved their right to oppose on terms. In conclusion, the chairman referred in eulogistic terms to the services which the officers of the company had rendered in the arduous fights they had had to preserve their rights, and mentioned Mr. Sydney Morse (solicitor), Mr. S. T. Dobson (the chief engineer), and particularly Mr. F. J. Walker (the general manager and secretary).

Sir J. H. Morris seconded the motion.

Replying to a Shareholder, the Chairman said it was an advantage for them to take energy from the Grove Road station. They held half the shares in the Central Co.; and, further than that, the electricity could be more cheaply generated at Grove Road.

Mr. Bourne referred to the action he took in urging forward the buying out of the founders' shares, and asked if the chairman thought the action was justified.

The Chairman said it was not an easy question to answer. They all said that with the shares at the present price the founders' shares would have been much lower than what the company gave for them. On the other hand, the existence of the founders' shares crippled the board in every way in putting away a reserve fund.

The report was adopted and the retiring director re-elected.

Lanarkshire Tramways Co.

The directors' report for the half-year ended December 31st, 1908, shows a revenue of £33,738, and expenses £18,301, leaving £15,437, less contributions payable to local authorities £1,119, interest on debentures £668, amounts written off £929, thus leaving £12,782. The balance brought forward was £5,155, so that there is available £17,937. Of this amount £7,500 has been placed to reserve for depreciation. A dividend at the rate of 6 per cent per annum on the shares for the half-year absorbs £9,240, and £332 goes to directors, (being 10 per cent. of net profits after payment of 5 per cent. dividend for the year). £865 is carried forward. The traffic receipts for the half-year show a decrease of £1,186, as compared with the receipts for the corresponding half-year of 1907. This is entirely due to trade depression. The net receipts, however, show an improvement, principally due to a reduction in permanent way repairs, which were exceptionally heavy in 1907 owing to the laying of the Motherwell water mains. All legal

expenses incurred by the company in connection with Bills promoted by various local authorities have been charged against revenue in the past year's accounts. The capital expenditure during the half-year was mainly spent on the two short extensions to the Hamilton Burgh boundary in Bothwell Road and to Coursington Bridge. A mess-room has been erected at the depôt for the convenience of the employés. The directors intend proceeding immediately with the extensions from Hamilton to Uddingston and from Wishaw to Newmains, and have decided to offer to the public at par 3,500 shares of £10 each, being the additional capital required towards the construction of these extensions. The prospectus was issued with the report. Applications from shareholders will receive preferential allotment.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June 30th, 1907 ..	15·82	6,009,522	£29,190	1·16d.	749,108	46
Dec. 31st, 1907 ..	15·82	6,760,649	£34,354	1·22d.	824,517	46
June 30th, 1908 ..	15·82	6,442,593	£33,887	1·24d.	830,558	53
Dec. 31st, 1908 ..	17 00	6,462,785	£33,168	1·23d.	818,355	53

Westminster Electric Supply Corporation, Ltd.

The directors' report for the year 1908 states that the supply of current, which on December 31st, 1907, was provided for the equivalent of 929,579 lamps of 8 c.p. (= 29,744 kw.), had increased by December 31st, 1908, to the equivalent of 985 159 lamps (= 31,525 kw). The length of the roadway in which continuous current mains have been laid now exceeds 86 miles, making about 343 miles of ways, into which upwards of 264 miles of copper (strip and cable) have been drawn. In addition, 5 miles of trunk mains (24 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood.

The Bill of the London and District Electricity Supply Co., which sought competitive powers throughout London, was rejected by Parliament during the last session, and the Bill promoted by this company in conjunction with other West End companies received the Royal Assent on December 21st last. Under this Act the companies have now power to link up their systems, and thus increase their efficiency, while by their inclusion in another Act promoted by other companies, powers to interconnect with all the other companies and local authorities in London have been also granted. Thus, for the first time, the undertakings throughout London are in a position to help each other to discharge their public obligations.

An interim dividend at the rate of 10 per cent. per annum on the ordinary shares and the dividend on the 4½ per cent. preference shares for the half-year ending June 30th, 1907, has been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £46,251, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £8,686, leaving a balance of £37,564. Out of this the board recommend the payment of a dividend at the rate of 10 per cent. per annum, less income-tax, for the past half-year, carrying forward £11,439. The following is a statement of the electricity sold, &c., for the year ending December 31st, 1908:—

Quantity utilised—Sold to consumers	18,315,792
Used on works for lighting, meter testing, &c.	233,226
Total	18,549,018

Number of lamps on circuit, December 31st, 1908, 985,159, or 31,525 kw.

Cambridge Electric Supply Co., Ltd.

The directors' report states that during the year ended December, 1908, there have been connected 102 additional consumers, having the equivalent of 3,924 (30-watt) lamps, making a total to date of 59,572. The number of units supplied during the year has been 660,158, an increase of 4,415 units. During the year a showroom for electrical fittings and appliances has been opened at the company's offices, and this is proving a great advantage. The supply mains have been further extended in several directions. The recently introduced metal-filament lamps, which give double the light of carbon-filament lamps while consuming about half the amount of energy, have the effect of reducing the receipts per consumer, but the directors anticipate that the consequent cheapening of the electric light will ultimately result in a large increase in the number of the company's customers. The accounts of the company show a total profit for the year of £7,846, which, added to £598, brought forward from 1907, makes £8,445. After deducting debenture and other interest, £1,634, placing £1,500 to depreciation fund account, which will bring up the total placed to the credit of that account to £13,000, and writing £100 off suspense account, there remains a balance of £5,211. An interim dividend of 2½ per cent., absorbing £2,120, has already been paid, and the directors recommend the payment of a further dividend of 3½ per cent., making 6 per cent. for the year. This will absorb £2,968, leaving £122 to carry forward. Last year the dividend was at the same rate.

Chelsea Electricity Supply Co., Ltd.—The directors recommend dividends for the half-year to December 31st, 1908, at the rate of 6 per cent. per annum on the preference shares, and 5 per cent. per annum on the ordinary shares, making 6 per cent. and 4½ per cent. respectively for the year 1908, after paying debenture interest and placing £11,854 to depreciation fund, £535 to debenture premium redemption fund, and writing off £826 from the cost of extinction of founders' shares; carrying forward £1,024, as against £904 in the previous year. The dividends will be payable on and after March 15th, 1909. Last year the ordinary dividend was at the same rate.

Liverpool Overhead Railway Co.

The half-yearly general meeting was held on February 9th, in Liverpool, Mr. Wm. Forwood presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, February 5th, page 226), said that the revenue of the railway for the past half-year showed a reduction of £3,823, and the expenditure a decrease of £2,996. The decrease in earnings was due to the falling-off in passenger traffic, there being a decrease of 637,165, making the smallest number of passengers carried since the tramway extension to Waterloo and Crosby. If they took the railway by itself they carried last half-year the smallest number since 1896, when their average fares were 10 per cent. higher. No city had suffered more from the general paralysis of trade than Liverpool, which meant a considerable decrease in the men employed about the docks. The different conditions now prevailing compared to those existing when the line was opened 15 years ago, were once again referred to. They had to accept the situation, which, he hoped, was not without some hope of brighter things with the advent of more prosperous times. Meanwhile, their directors had been actively engaged in trying to effect small economies which they trusted would in the aggregate effect a substantial reduction in working expenses. By the action they took in appealing against their assessment they had saved altogether £1,800 per annum in rates. By increasing their service to one of five minutes and decreasing the speed of the trains, they were saving in their coal bill and stores about £1,200 per annum, besides a considerable saving in wear and tear, which it was difficult to estimate. They had also effected a saving by closing some of their stations early in the evening. Although the past half-year had benefited to some extent by those economies, they would not be fully felt until this half-year. The chairman went on to allude in detail to the various economies that had been effected. The total expenditure per train-mile was 13·66d., against 16·25d. (434,456 miles) for the corresponding period. If renewal and contingent fund were deducted, the expenditure would be only 13·11d., against 15·61d. Again, they worked and maintained more stations, and compared with:—

	Pence per mile.	Train-mileage.
City and South London Railway ...	14·17d.	614,691
Central London Railway	29·0ud.	776,655
Mersey Railway (December, 1907) ...	21·51d.	416,189

That was the lowest expenditure per train-mile since the line had been opened, with the exception of December, 1894, and in comparing it with the figure previous to the introduction of the accelerated service, it was lower, chiefly because of one station being closed entirely, and several others limited to certain times. It was also the first time they had been below the City and S.L. Railway expenditure per train-mile. The revenue per train-mile was 17·16d., against 20·45d., and compared with: City and S.L. Railway, 30·39d.; Central London Railway, 61·35d.; Mersey Railway (December, 1907). 29·43d. So that, if they could get the same revenue per train-mile as the other companies referred to at their present expenditure per train-mile, their net revenue would be very largely increased.

Mr. H. C. Woodward seconded, and the motion was carried without discussion, as was also a resolution to pay the 5 per cent. preference dividend.

Mackay Telegraph Companies.—A Reuter dispatch to the *Financier* states that the annual report of the Mackay Companies, which was issued in New York on 15th inst., states that, during the year 1908, the earnings of the Commercial Cable Co. (which has paid regular quarterly dividends for over 19 years) showed a decrease in gross receipts and net profits. This was due to the fact that in the spring of that year powerful steam fishing vessels operated their deep-sea nets, called trawls, on the bottom of the ocean, off the coast of Ireland, in such a manner as to disrupt the submarine cables of the Commercial Cable Co., as well as of other cable companies. The interruption so seriously affected public business that protests were made by commercial bodies, not only throughout the United States, but in England. Notwithstanding this decrease in the gross receipts and net profits of the Commercial Cable Co., and notwithstanding the depression of business which prevailed throughout the United States during the past year, growing out of the panic and financial crisis of the autumn of 1907, the profits which the Mackay Companies might draw from the companies which they control have increased.

Imperial Tramways Co., Ltd.—Sir George White presiding at the annual meeting of this company last week, expressed their keen disappointment at the inability of the London United Tramways, Ltd., to pay the whole of their preference dividend. If the present cut-throat competition in fares came to an end, matters ought very quickly to adjust themselves. He hoped that the London United would at no distant date resume payment of the 5 per cent. dividend, and in that case this company would be in a position to pay the same dividend on the ordinary, as they had hitherto done. In the meantime, it was an exceedingly comforting fact that years ago, when they distributed large profits in one year, they set aside an ordinary shares dividend fund. But for that fund there would have been no dividend on their ordinary shares this half-year, but happily that fund was sufficient to continue the 4 per cent. dividend, and it would certainly last more than sufficient time for the L.U. Tramways to pull round. The report was adopted.

MARKET QUOTATIONS.

Wednesday, February 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Copper Sulphate	,,	£21	..
a Lead, Nitrate	,,	£23 10	..
a ,, White Sugar	,,	£23	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	9d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£10 15	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b ,, Wire, in ton lots	,,	£112	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£50 to £135	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	..
c ,, Tube (brazed)	,,	8½d.	..
c ,, (solid drawn)	,,	7¾d.	..
c ,, Wire, basis	,,	6¾d.	..
c Copper Tubes (brazed)	,,	9½d.	..
c ,, ,, (solid drawn	,,	1/1½d.	..
g ,, Bars (best selected)	per ton	£72	..
g ,, Sheet	,,	£72	..
g ,, Rod	,,	£72	..
e ,, (Electrolytic) Bars	,,	£62	£1 dec.
e ,, ,, Sheets	,,	£78 10	£1 dec.
e ,, ,, Rod	,,	£66 10	£1 dec.
e ,, ,, H.C. Wire	per lb.	8¾d.	¼d. dec.
f Ebonite Rod	,,	3/3	..
f ,, Sheet	,,	3/-	..
n German Silver Wire	,,	1/6	..
h Gutta-percha, fine	,,	5/6 to 6/6	..
h India-rubber, Para fine	,,	5/3½	2½d. inc.
l Iron Pig (Cleveland warrants)	per ton	48/-	6d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£13 15	10s. inc.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 7 6	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	1/0½ to 1/2	..
p ,, ,, rolled bars & rods	,,	1/2½ to 1/3½	..
p ,, ,, rolled strip & sheet	,,	1/8 to 1/6	..
o Platinum	per oz.	100/-	variable.
e Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£130 10 to £131 10	£3 10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals:—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vielle Montagne bnd.)	,,	£25 5	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

National Electric Supply Co., Ltd.—At the annual meeting held at Fishergate, Preston, on February 11th, dividends were declared at 4 per cent. for the year on the preference shares, and 5s. per share on the ordinary shares for the half-year, making with the interim dividend paid in July, 8s. per share for the year, and £2 14s. 3d. per share on the founders' shares. Last year the company sold about 97,000 units more than in 1907, though owing to the lower rates paid by the Corporation for the public lighting, the net revenue disclosed an increase of only £264.

Switzerland.—La Société d'Electricité Alioth, of Basle, reports a profit of £42,920 for the last financial year, as contrasted with only £35,147 in the preceding 12 months. A dividend of 6 per cent. is being declared on both the preference and ordinary shares.

British Electric Traction Co., Ltd.—According to the daily Press, a dividend of 1½ per cent. is announced on the preference shares of this company.

STOCKS AND SHARES.

Tuesday Afternoon.

Stock Exchange business plods along on lines, which, take them on the whole, are not bad. The worst of it is that orders come so erratically; one day is animated, the next idle. Markets lack staying power more than anything else. The King's Speech produced little material effect, but the Budget statement is awaited with a touch of anxiety.

Electricity departments remain firm enough, and the blocks of new securities recently left in the hands of underwriters are stated to be gradually finding their way into more permanent quarters. It is remarked that although the public are shy, in certain cases, of subscribing money upon the issue of prospectuses, they will buy the stock or share avidly as soon as a small premium is apparent. But most of the new issues nowadays are being taken like the proverbial "hot cakes."

Excellent progress is shown by the accounts of the three junior Tube Railways, the Bakerloo, the Piccadilly, and the Charing Cross and Euston. No doubt the Franco-British Exhibition played no small part in adding density to the traffics of the Tubes, but beyond such adventitious aid, the reports, now to hand, of the companies, are eloquent—in their figures—of good management and economical working. Bakerloo Debenture firmed up to 96, Great Northern and Piccadilly Debenture is steady at 92, while the Charing Cross, Euston and Hampstead Debenture stands at 90.

Some idle speculation was aroused at what might be the motive actuating a purchaser of Great Northern and City Preferred Ordinary shares, who gave 7s. 6d. for them on Monday.

District stock gained ¼ upon Sir George Gibb's hopeful speech at the meeting, and Underground Electric Railways 6 per cent. income bonds improved to 30, a gain of 3 points. The latter movement owed its inspiration, of course, to the reports of the tube railways just mentioned. Investors with a fancy for a dash of speculation may find something to their taste in this company's 4½ per cent. bonds, which are reasonably secured, and offer a yield of practically 5½ per cent. on the money.

Of the other undergrounds, Central London Ordinary stock quickly regained the deducted dividend of 1⅝, though the Preference, *ex* 2, are lower by that amount, and the Deferred at 46 is *ex* 2½. A little inquiry for the City and South London raised the price to 27½. Metropolitans have been better, but they fell back again to their last week's price.

Further dividends have been declared upon some of the metropolitan electricity supply companies' shares, but still the market continues apathetic and without attracting public interest. Charing Cross and West End Ordinary and the "City undertaking" Preference are both ½ lower on the figures lately published, which seem to have disappointed a few of the proprietors of the shares. Westminsters gained ½ when the report came out. The principal rise in this section, however, was secured by London Electric Ordinary shares, which rose 5s. 6d., allowing for the fact that the price is *ex* 1s. 9½d. dividend. The advance is based on the optimistic speech of the chairman at the meeting. Brompton's are ½ down, Metropolitan and City "Lights" ⅛ up. Fluctuations, apart from the London company's shares, are small and insignificant. Victoria Falls Power Preference advanced to very nearly their par price of a pound, the latest revival in Kaffirs directing further attention to them.

Mexican Light and Power Common relapsed to 81½, a fall of 3½, but both the Preference stock and the 5 per cent. bonds are slightly better. Mexico Trams are 3 points easier, and Rio de Janerio Shares, after being 6 points higher at 106, came back to 101. The company, it may be observed, has not yet paid a dividend on its Ordinary capital, and a further new issue at par is rumoured. Shawinigan Water and Power stock is a feature of strength, being several points better at 103½. Canadian General rose ½ to 115. It is said that there is some financial trouble at Brussels, which reacts upon the Canadian-Mexican descriptions as a whole.

These Canadian issues move so quickly as to rob more sedate stocks and shares of pronounced interest, but, speaking generally, the market is firm. Anglo-Argentine Preferences are better, and the old 4 per cent. Debenture reverted to 91. Buenos Ayres Grand Nationals had an all-round advance the other day; the Ordinary shares have reached 2⅞ and the Preference 3½, *ex* 2s. 6d. dividend. British Electric Tractions underwent no change upon deduction of 3s. dividend from the price of the Preference shares.

Marconi shares continued to improve, and another rise of ⅛ was registered, but this was lost in consequence of the lawsuit brought against the company by a Dutch undertaking formed to work the Marconi system in Holland. Telegraph descriptions are mainly good, as may be seen in a glance by noticing 2s. 6d. rises in Globe Ordinary and Preference shares. Eastern Extensions rose 10s., and Eastern Telegraph 2 points. Western Telegraphs and Direct United States are each 5s. better. The Anglo-American trio, in which prices are marked *ex* dividend, has also hardened.

National Telephones crept up a little, and Reuters rose 5s. Manufacturing shares display a general strength, in which Dick, Kerr Ordinary and Preference are noticeable. Henley's hardened ¼, and Callender's an equal fraction, while Babcock Ordinary spurted to 4⅛, representing a rise of 6s 3d. within the last fortnight. A new issue of capital is being made by a Winnipeg electrical undertaking.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Feb. 9th.	Closing Quotations Feb. 16th.	Business done week ended Feb. 16th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2¾ — 3¼	2¾ — 3¼	62/6	57/6	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 3 1
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	..	130 —133	133 —133	133½	132½	+2	5 18 6
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	55 — 58	55 — 58 xd	57	56	..	5 5 3
3,300,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —101	99 —101 xd	101	99⅜	..	5 18 10
3,300,910	Do. do. do. Deferred	Stock	½ %	1¾ %	1 %	8/-	18⅝— 19⅞	13½— 14	14	13½	+ ⅛	2 16 10
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8	8	8	..	7⅞— 8⅛	7⅞— 8⅛	..	..	..	4 15 6
2,481,350	Commercial Cable Sting. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	84½— 86½	85 — 87	85⅝	85⅛	..	4 12 6
16,000	Cuba Telegraph	10	5	5	6	..	7⅛— 8½	8 — 9	8½	..	+ ⅛	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½— 17½	16½— 17½	..	..	..	5 14 3
12,381	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3 — 3½	3 — 3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	8 16 6
53,700	Direct United States Cable	20	4½%	4½%	4½%	4½%	12 — 12½	12½— 12⅝	12⅝	12⅜	+ ⅛	6 9 3
53,700	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½—101½	99¼—101¼	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	126 —129	128 —131	128½	126½	×2	5 6 10
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	..	84½— 86½	84½— 86½	86⅛	85⅜	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103⅜—105½	103⅜—105½	105	103⅜	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	11⅛— 12½	11¼— 12⅜	12⅛	11⅛	+ ⅛	5 13 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99½—101½	100 —102	100⅜	100⅜	+ ⅛	3 18 5
200,000	East & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½—102½	100½—102½	..	..	..	3 18 1
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10 — 10½	10½— 10⅝	10⅝	10⅛	+ ⅛	5 10 11
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	12⅝— 13⅛	13 — 13½	13⅝	13⅛	+ ⅛	4 8 11
150,000	Great Northern Telegraph, of Copenhagen	10	34%	20 %	20 %	..	30 — 32	30 — 32	31⅛	..	..	6 5 0
24,300	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99½—101½	99¾—101¼	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	..	52 — 55	52 — 55	53½	..	..	6 16 4
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	74 — 78	74 — 78	..	..	..	5 .2 7
$50,000,000	Do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	71 — 74	71 — 74	..	..	..	5 12 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞— 1	⅞— 1	17/6	16/3	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 0 9
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅞— 1	⅞— 1	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 —111	100 —111	110	..	..	5 7 7
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	120½—122½	121 —123	122½	121⅞	+ ⅛	4 17 7
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11⅛	10½— 11⅛	..	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 11⅛	10½— 11⅛	..	..	..	5 6 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5 1/16	..	..	4 5 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97½— 99½	..	..	+ ½	3 10 4
1,716,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99½—101½	99¾—101¼	101	..	..	3 18 10
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	..	1⅛— 1⅜	1⅛— 1⅜	27/8	..	..	5 16 1
50,000	Do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1⅛— 1⅜	1⅛— 1⅜	24/-	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7⅛— 8⅛	..	..	+ ⅛	4 17 7
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	98½—100½	99½	..	— ⅛	4 9 7
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6½— 7	6⅝— 7	6 1/16	..	..	5 14 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅝— 5⅜	4⅝— 5⅜	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 2 6
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	12⅝— 13⅛	13 — 13½	13⅜	12⅞	+ ⅛	5 8 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102½	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅝— ¾	⅝— ¾	..	..	..	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	5 %	6 %	7⅝— 8⅛	7⅝— 8⅛	7¾	..	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7⅜— 8½	7⅜— 8½	..	..	..	2 14 1
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

890,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	..	8⅛— 9⅛	8⅛— 9⅛	9⅛	8⅛	..	4 19 2
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	6¾%	..	5⅝— 6⅛	6 — 6½	6⅛	6	+ ⅛	4 12 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	137 —142	137 —142	..	..	..	4 4 6
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	103	..	..	4 17 1
880,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	..	4⅛— 4⅜	4¼— 4½	89/4½	88/6	+ ⅛	4 11 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1⅝— 2	1⅝— 2	..	..	..	17 10 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3⅛— 3⅝	3⅛— 3⅝	..	..	..	8 12 5
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3½— 4⅛	3½— 4⅛	85/-	..	..	7 1 2
12 897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¼— 4¼	3½— 4½	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 98	96 — 98	98	..	..	5 12 3
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	186 —189	186 —189	189	..	..	5 15 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	116 —120	116 —120	118½	116	..	5 0 0
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	104½—106½	104½—106½	106	..	..	4 13 11
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,350	40	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	10 15 8
290,000	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,361	British Electric Traction	10	3 %	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..	Nil
161,457	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	3⅝— 3¾	3½— 3¾ xd	73/9	70/-	..	7 14 10
1,478,678	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	90 — 95	90 — 95	92	90½	..	5 5 3
598,998	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	73½	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	..	6⅞— 7⅛	6⅞— 7⅛	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	6⅛— 6⅜	6⅛— 6⅜	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	90 — 95	90 — 95	..	..	..	4 14 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	44 — 49	43 — 48	44½	..	—1	8 6 8
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	⅝— ¾	⅝— ¾	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	..	0 — ½	0 — ½	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	0 — ½	0 — ½	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	59 — 64	59 — 64	..	..	..	7 0 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	..	38 — 42	38 — 42	..	..	..	10 14 4
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4½— 5	4½— 5	96/3	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,290..	5	5 %	5 %	5 %	5 %	4½— 5½	4½— 5½	..	..	..	4 15 3
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9 — 10	9½— 10½	..	..	+ ⅛	7 6 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5½— 5⅝	5½— 5⅝	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	106 —107	..	..	..	4 4 1
491,232	Cape E Trams., 1 to 491,232	1	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	4/6	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1¼— 1⅝	1⅜— 1½	33/-	32/-	+ 1/16	7 10 1
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	102 —106	103 —107	..	..	+1	4 4 1
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	63 — 65	60 — 63 xd	..	..	..	5 3 2
563,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	82 — 84 xd	..	..	..	4 15 3
563,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	47 — 49	45 — 47 xd	..	..	..	5 2 0
1,480,000	City and South London Railway	Stock	1¾%	2¼%	2¼%	1½%	26½— 27½	27 — 28	27½	26⅝	..	5 5 8
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	..	1½— 1¾	1¾— 1¾	..	..	..	10 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Feb. 9th.	Closing Quotations Feb. 16th.	Business done week ended Feb. 16th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1 1/8	1 1/8 — 1 1/16	24/9	..	+ 1/16	7 12 5
305 000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/8 — 1 1/4	..	..	+ 1/16	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	100 —108	..	..	+1	4 8 8
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6 %	6¼%	6 %	11¼ — 12½	11¼ — 12½xd	..	..	..	4 18 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13 — 14	12½ — 13½xd	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	3 5	4½%	4½%	4½%	..	7/16 — 7/32	7/16 — 7/32	..	..	..	16 15 3
17,189	Do. "A" shares, 01—017,189	1 5	4½%	4½%	4½%	..	1¼ — 2¼	1½ — 2½	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	75 — 78	75 — 78	..	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	86 — 89	85 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1½ — 1½	1½ — 1½	..	..	..	9 6 9
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 — 7½	7 — 7½	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..	4 9 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	1¾%	Nil	1/32 — 1/16	1/32 — 1/16	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	10	5 %	5 %	5 %	5 %	102 —103½	102 —106	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11¾ — 12¼	12 — 13	12⅜	..	+ ¼	5 12 5
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½—107½	106 —108	..	..	+ ½	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	..	15¼— 16½	15½— 16½	16½	..	..	6 1 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	1 — 1 1/16	1 — 1 1/16	..	..	..	5 6 8
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5½	4½ — 5½	..	..	— ½	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	..	6½ — 6¾	6½ — 6¾	..	..	..	4 8 11
899,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	..	6½ — 6¾	6½ — 6¾	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	..	4 — 4½	4 — 4½	..	..	..	11 2 2
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	71 — 75	71 — 75	..	..	..	6 0 0
5,782,082	Metropolitan Consolidated	100	2½%	1 %	½%	½%	36 — 37	36 — 37	37½	36½	..	1 6 8
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	69 — 71	69 — 71	71	69½	..	3 17 6
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	14 — 14½	14½ — 14¾	14⅞	14⅜	..	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	2 — 2 1/16	2 1/32 — 2 1/16xd	..	..	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 97	93 — 96	96	94½	..	4 13 9
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	143 —145	141½—143½xd	144	142½	..	..
$9,000,000	Do. 1st Mort. 50-year £% Gld. Bds.	..	..	..	..	..	94½— 95½	92 — 95	95⅞	94⅞	—1½	..
245,500	Potteries E. Tro.	1	4 %	4 %	4 %	..	1/32 — 1/16	1/32 — 1/16	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	1/32 — 1/16	1/32 — 1/16xd	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	90 — 93	90 — 93	..	..	..	4 14 9
37,850	Telegraph Construction and Maintenance	12	15 %	5 %	17½%	15 %	32½ — 34½	32 — 34	..	..	— ½	5 14 10
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½ —101¼	99½ —101¼	..	..	..	3 18 10
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	98½ — 99½	98½ — 99½	99½	98½	..	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	80 — 82	81 — 83	..	..	..	5 9 9
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	26 — 28	29 — 31	28	27⅞	+3	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	..	3/32 — 1/8	3/32 — 1/8	..	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	..	2⅜ — 2¼	2⅜ — 2¼	52/6	..	..	10 8 8
216,404	Do. 4 % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1

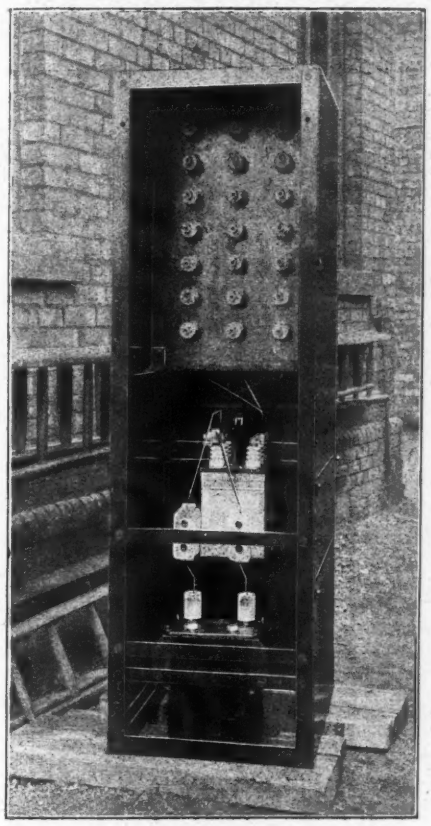
ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	..	4½— 5	4½— 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10 0
80,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	..	8⅜ — 8⅞	8½ — 8⅝	8⅝	⅞	— ⅛	5 14 3
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	8 — 8⅜	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98 —101	98 — 101	..	..	..	3 19 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4¼ — 4⅜	88/9	87/6	— ⅛	5 5 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜xd	90/-	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	4⅜ — 4½	4⅜ — 4⅛	..	..	— ⅛	5 9 1
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	97½	97	..	4 1 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅞ — 4¼	3⅞ — 4¼	79/1½	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 11	10⅜ — 11⅛	10⅞	10 11/16	+ ⅛	5 6 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 12⅜	12 — 12⅜	..	..	..	4 14 1
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	101⅛	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 3	2⅜ — 3	..	..	..	3 6 8
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	..	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	6 13 4
220,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	..	8⅜ — 9⅛	8⅜ — 9⅛	9 1/16	8 15/16	..	5 8 1
59,997	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅜ — 11⅛	10⅜ — 11⅛	11	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	102⅛	102	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	..	1/32 — 1/16	1/32 — 1/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	..	1/32 — 1/16	1/32 — 1/16	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 62	59 — 62	..	..	..	7 0 8
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	..	85 — 87	85 — 87	85½	84⅛	..	..
10,000	Folkestone, 1 to 10,000	5	5%	5%	5%	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	5	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15.000	Hove, 1 to 15,000	5	9 %	9 %	8½%	..	6⅛ — 7	6⅛ — 7	..	..	..	6 1 5
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	96 — 98	96 — 98	..	..	..	5 3 1
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	..	7⅜ — 8⅛	7⅜ — 8⅛	..	..	..	6 1 3
90,000	Do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 96	93 — 96	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅜ — 1⅞	1⅜ — 2⅛xd	40/-	38/9	..	4 16 0
70,000	Do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛xd	5⅛	5 1/16	..	5 14 3
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	90 — 94	90 — 94	94	..	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6¼%	..	4⅜ — 5⅛	4⅜ — 5⅛	98/9	..	+ ⅛	6 3 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	..	4⅜ — 5	4⅜ — 5	95/-	92/6	..	4 10 0
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —109	105 —108	..	..	..	4 2 7
948,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	85⅜	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	87⅞ — 88½	88½ — 89½	89⅜	87⅞	+ ⅜	5 12 1
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	33⅓%	84 — 86	80½ — 82½	85	81½	—3½	4 4 10
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	110½—112½	111 —113	112½	..	+ ½	6 3 11
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	91 — 92	91½ — 92½	92½	91½	+ ½	5 8 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	..	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	9 2 10
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	100 —102	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	..	11⅛ — 11⅝	11⅛ — 12⅛	..	..	..	6 5 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	..	..	1⅜ — 1⅝	1⅜ — 1⅝	24/6	21/-	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	..	1 1/16 — 1 1/8	1 1/32 — 1 3/32	..	..	+ 1/32	5 14 3
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	5 %	99 — 102	99 —102	..	..	..	4 18 0
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅜ — 8¾	8⅜ — 8¾	8⅝	..	..	5 12 8
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	..	1/32 — 1/16	1/32 — 1/16	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 70	68 — 70	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	4	4 %	3 %	4 %	..	2⅛ — 2⅜	2⅛ — 2⅜	56/10½	52/6	..	6 10 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	1/32 — 1/16	1/32 — 1/16	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 12 0
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅞ — 1	⅞ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅝ — 2	1⅝ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	13/16 — 15/16	13/16 — 1	17/6	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8⅜ — 8⅝	8⅜ — 8⅞	8⅞	..	+ ⅛	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

REYROLLE MINING SWITCH PANEL.

The accompanying illustrations show a new type of oil-switch panel which has been introduced by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne.



Back of Panel, Open.

In this board the distribution to the various circuits is effected by means of plugs, which connect the bus-bars shown on the front view to the sockets shown on the back view.

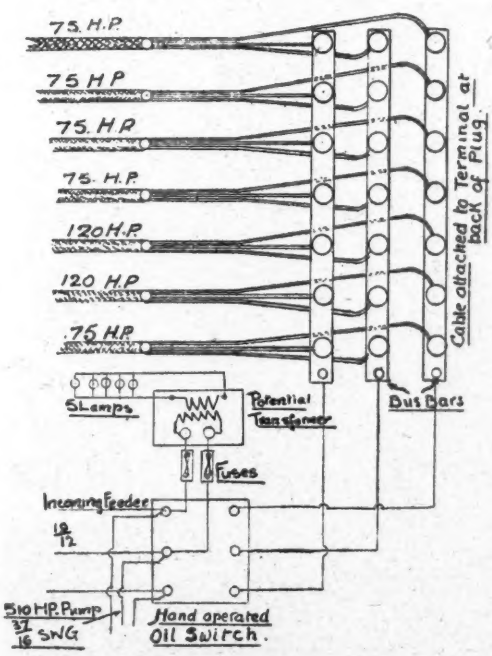


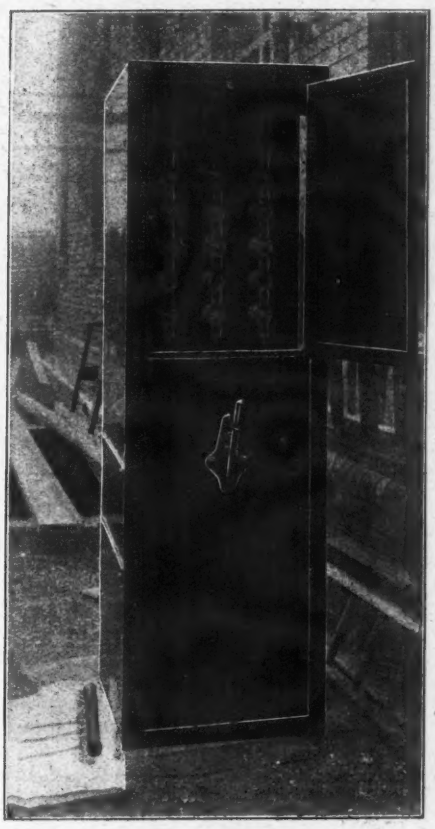
Diagram of Connections.

In the front view it will be seen that the plugs on the circuit second from the bottom have been removed, and have been placed outside the panel on the ground, together with a removable insulating handle, which can be used to remove any one of the plugs.

The door at the top, giving access to the plug board, is interlocked with the oil switch in such a way that it cannot be opened unless the bus-bars have been made dead, and the bus-bars cannot be made alive until the door is properly shut.

Turning to the back of the panel, provision is made for taking off seven sub-circuits, and a pressure transformer and fuses are provided, in order to operate an indicating lamp, &c.

In the present case the oil switch has no automatic features, but, of course, it would be a simple matter to add no-voltage and overload releases. With regard to the advantages of this kind of



Front of Panel.

board, the makers state that absolute safety is the leading characteristic, and after this comes cheapness. With an ordinary design it would be necessary to have high pressure bus-bars, and seven separate oil switches or air-break switches, which would probably make the cost prohibitive, although it would, of course, make it possible to isolate any section without interference with other sections.

The Economics of Central Stations.—The false economy due to the erection of numerous small central stations is attracting attention in Germany, where the system has led to excessive capital expenditure and higher charges to consumers than would have been the case if large works had been built at first. The causes of this unfortunate state of affairs are two-fold in character. In the first place, the blame is placed upon the electrical companies, which, in the impetuosity of their early years, were far too eager to promote the establishment of new central stations; secondly, the responsibility is laid upon municipal or communal socialism, which was so ill-understood and applied that, as in this country, every local authority of little competence thought it to be its duty to construct and carry on a central station. Dr. H. Schacht, in a recent issue of the *Preussische Jahrbucher*, refers to this antiquated system, and contrasts it with the high technical level now attained in the manufacturing departments of the industry. The development of central stations during the past decade is set forth in detail, showing that the number of central stations in the period in question increased twice as much as the size of the individual stations. The author submits that an end should be made of the system of splitting the work up among small stations, and a substitute provided by promoting the movement for concentration. In connection with this point, reference is specially made to the circumstance that the economic autonomy of the communes in the matter of tramways leads to extravagance, and it is suggested that the Government should co-operate with private and communal "undertakers" in the production of electrical energy.

COMBINED TRACK CIRCUIT AND CAB SIGNALLING.

A Reply by Capt. A. GARDINER, R.E.

(*Continued from page* 246.)

The diagram shows the general principles only under which I would equip the junction quoted as an example for my signal. It does not show the special safety contrivances, such as duplicate relays, additional insulating fish-plates, and so on, that the experience so far gained in practical working with the track circuit may indicate as desirable. Further, purely to elucidate the diagram, which is of necessity on a small scale, I have omitted the cross-over shown on the left of the junction in the diagram of December 11th. I trust it will be recognised that there would be no more difficulty in dealing with this cross-over in any reasonable way than with the rest of the junction.

In framing new rules (*f*), (*g*), (*h*) and (*i*) on which the signalling of this junction would be carried out, I have adhered as closely as feasible to the wording of the original rules as given in the letter under reply.

New rule (*f*):—

When permission has been given by B for a train to approach from C (*i.e.*, when the section 6-8 shows "clear" for a train from C), (1) the sections 4-6 and 4-10 shall be free from all obstruction; (2) the points P_2 shall be set for the straight; (3) the section P_1-9 must be free from all obstruction; (4) the section 10-12 must "stop" within it an approaching train from D; (5) and must continue to "stop" it there until that from C has passed through the junction and proceeded beyond the point 4 which shall be not less than — yards from the junction. And in such case (6) the section 1-3 shall "stop" within it a train approaching from A, unless the junction points P_1 are set for C and (7) the line towards C is free from all obstruction up to the point 5, which shall be not less than — yards from P_1. Further (8), it shall be impossible to alter the points P_1 from for the straight (C) to for the branch (D) at any time after the train approaching from C shall have passed the point 8, and until the whole of it shall have passed the point 4; and to alter the points P_2 from for the straight (C) to for the branch (D) at any time after the train approaching from C shall have passed the point 6, which shall be not less than — yards from the junction, and until the whole of it shall have passed the point 4.

This is secured as follows (see diagram). The signal current from battery B_6 is controlled by relay (or relays) R_6, which is (or are) common to the sections 4-6 and 4-10 ensuring (1) above; it is then passed through switch S_2, which is operated by the points P_2 ensuring (2); then through the contacts of relay R_2 of the sections 3-5*a* and 3-9 ensuring (3); thence to points switch S_7, which is closed only when the points P_1 are set for C ensuring (6). The section 1-3 can then, owing to the control of relay R_3, show "clear" to a train from A provided only the section 3-5*a*-5 is free from all obstruction, ensuring (7). No. (4) is fulfilled by taking the signal current for the section 10-12 from the same battery as that for 6-8, and causing it to "clear" either 6-8 or 10-12 according to the position of the points, but not both; while (5) is secured by the control effected by track relay R_6. Condition (8) is a simple matter of magnetically controlled pawls on the pointsman's levers for the points P_1 and P_2 respectively.

New rule (*g*):—

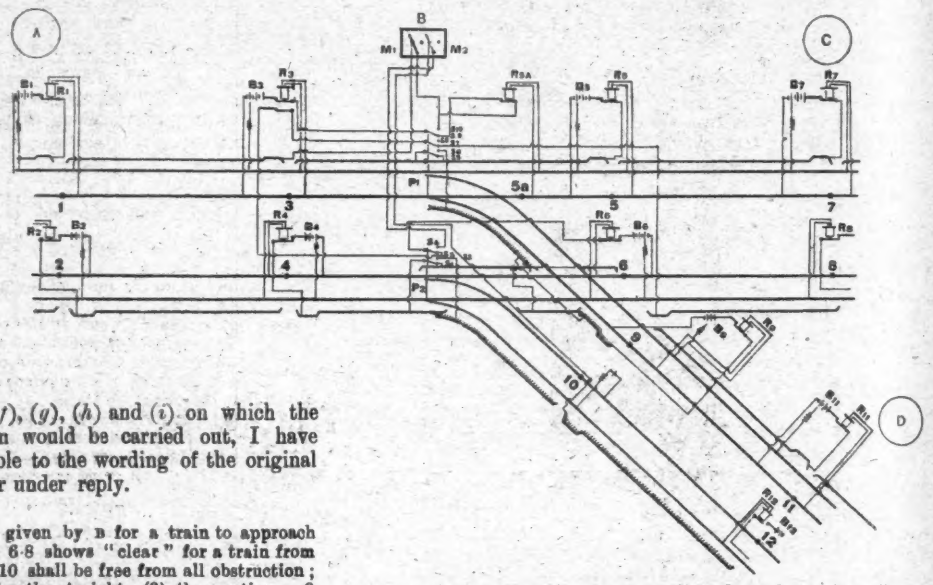
When permission has been given by B for a train to approach from D (*i.e.*, when the section 10-12 shows "clear" for a train from D), (1) the sections 4-6 and 4-10 shall be free from all obstructions, (2) the points P_2 shall be set for the branch, (3) the section 6-8 must "stop" within it an approaching train from C, and (4) must continue to "stop" such train there until that from D shall have passed the point 4. Further (5), it shall be impossible to alter the points P_2 from for the branch (D) to for the straight (C) at any time after the train approaching from D shall have passed the point 10, which shall be not less than —— yards from the junction and until the whole of it shall have cleared the point 4.

This is secured as follows:—The signal current from battery B_6 is controlled by relay R_6 ensuring (1) and (4); it is then passed through points switch S_4 ensuring (2) and (3). No. (5) is ensured, as usual, by a magnetic pawl on the pointsman's lever.

New rule (*h*):—

When permission has been given by B for a train to approach from A for D (*i.e.*, when 1-3 shows "clear" for a train from A for D), (1) the sections 3-5*a* and 3-9 shall be free from all obstruction (2) the section 6-8 must "stop" within it an approaching train from C, and (3) must continue to "stop" such train there until that from A shall have passed the point 9.

This is secured as follows:—The signal current from



B only is a pointsman's box. Shaded track conductor denotes "stop."

Diagram of Connections at a Junction.

battery B_3 is controlled by relay R_3 ensuring (1); thence through points switch S_{10} ensuring (2), since for 6-8 to show "clear" to an approaching train, the points P_1 must be set for the straight. The signal current for the section 6-8 is further controlled by relay R_3 ensuring (3).

New rule (*i*):—

When a train from A has passed the junction, and (1) the rear of the train is clear of the point 5*a* or 9 as the case may be so as not to foul the junction, the section 1-3 may show "clear" to a following train from A, provided (2) the points are set for the following train to pass on to another line, and that line is free from obstruction throughout the whole of the section next to be entered upon by the train, and provided the instructions given in the preceding paragraphs can be complied with.

The method proposed for dealing with this rule is shown at 5*a*; and it will frequently be possible to interpolate similar points elsewhere when traffic will be facilitated thereby. The relay R_3 is controlled by the section 3-5*a*, 3-9 (or it might be 9*a*), and the presence of a train in the section 5*a*-5 will not cause a "stop" signal in the section 1-3, provided the points P_1 are set for the branch, and the branch is clear up to 9 (not, in this case, 9*a*). When, on the other hand, the points are set for the straight, the signal current is controlled by R_3, S_9 and R 5*a*; so that, in this case, the presence of a train in 5*a*-5, short-circuiting the relay R 5*a*, will cause an approaching train to be stopped in the section 1-3. Old rule (*j*) will drop out. With sections already as short as safety permits, both the possibility of, and the necessity for, such conditional working, involving as it does risks to staff and property not allowed in the case of passenger trains and permitted with goods trains only in order to reduce delays arising from block sections of a length unavoidable if the cost of manual signalling is to be kept within bounds, disappear.

I have so far made no reference to the pointsman's levers M_1 M_2 shown in my drawing. Up to this I have described the track as indicating its state automatically without human control; and I have done so (or if, as is quite possible, there are some errors in detail, I as yet believe that it is at any rate possible to do so) without

affecting the safety of traffic. "So far as indicating the state of the track is concerned" the signal fulfils all requirements. But now the need of power to "select" steps in.

Signal boxes A C and D, as illustrated in "The Writer of the Article's" letter of December 11th, disappear with their staff; and yet the lengths of the block sections, which so closely affect the power of dealing with traffic expeditiously, are reduced and not increased. At the next stations or junctions on either side, where points have to be moved, and the order of trains rearranged, there will be pointsman's boxes for the purpose of performing similar duties to those of B. As these rearrange their trains and send them forward under the protection of the automatic signals along the intervening "straights" to B, they will signal forward their destinations either with or without automatic aid such as is afforded by the train indicators of the British Westinghouse Co.'s pattern on the District Railway. On entering the section left of 1 on my diagram, right of 8, or right of 12, these trains will, by means of the track circuit, announce *forward* to B their approach.

Let us assume that these trains announce their presence almost simultaneously, that the train from A is for D, that the train from D is a "goods," and that the pointsman wishes to give precedence to the train from C. He will throw his points P_1 and P_2 over to for the straight. This will stop the train from D in the section 10-12. The train from A would be, I will not say unaware, for my paper at Leeds indicated methods of making the driver aware of how the track is set; but he would be in receipt of a "proceed" indication, which, while in no way *dangerous*, would take him to a wrong destination. Hence the human element steps in, and by the lever M_1 in box B "stops" the train from A in the section 1-3.

On the train from C passing the junction, assume that a second and important train announces its approach from the same direction. The pointsman wishes the train from A to proceed first to D, and to do so must pull over points P_1 before the new train from C comes dangerously close (*i.e.*, before it passes the point 8) and set his lever M_1 to "clear."

The points movement automatically "stops" the new train from C in the section 6-8, while the goods continues to be held up in 10-12 by keeping the points against him. Immediately the train from A proceeds beyond the point 9, provided the points P_1 have been returned to for the straight, the second train from C gets a "clear" indication. As soon as it has passed the point 4, by setting the points P_2 for the branch the train from D gets its "clear" signal, and can proceed.

I think this makes my "dictum" as to manual control clear. If it is badly expressed in my Leeds paper I apologise. One cannot always foretell which particular remark in such a compilation will be subjected to the closest scrutiny.

If, however, it is desired to give a pointsman power to "stop" a train (although the indication may without inconvenience be left to the track itself) as provided for by the lever M_2 in the diagram, I have nothing special to urge against it, except that for every-day use it appears to involve unnecessary expense and work. The provision of such lever for use in any unforeseen emergency might possibly be advisable; but if so, I would suggest its provision for this purpose only, the lever being normally set at "clear."

(*To be concluded.*)

Proposal to Transfer the Flange from Wheel to Rail.—On the face of it, the idea conveyed by the heading sounds absurd, and a perusal of the paper read by the inventor before the recent American Street Railway Association does not induce any higher opinion. Mr. Voyning thinks that all kinds of advantages would follow the use of a flangeless wheel running on a flanged rail. The discussion produced nothing but dissent, and several speakers considered that the new rail would invite wagon traffic, which is just the thing that causes so much wear on the present rail and so much obstruction to traffic, and so many opportunities for collision. Of course, the use of such a section would be prohibited in England on account of the wide troughs, 1 in. deep, which would be formed in paved streets, while the special work would be impassable by ordinary vehicles. Why the author was allowed to waste the time of the Association we cannot imagine.

SEARCHLIGHTS IN NAVAL WARFARE.

Since the arrival of the searchlight it is surprising that there has been so little progress where it is most needed. There is, perhaps, no field where the searchlight has so much scope for showing its utility as in the Navy. On a dark night a fleet in the open sea is at the mercy of prowling torpedo boats, which, lying in the offing, inconspicuous against dark masses of low-lying clouds or the dull carpet of the ocean itself, can easily make out the tall forms of their larger adversaries silhouetted against the sky from a distance at which they themselves are invisible.

It would seem at first sight that the area commanded by a searchlight would be of sufficient extent to keep torpedo boats, if they were to remain invisible, out of torpedo range, and that if they came within the light-swept area they could immediately be disposed of by gun-fire.

In practice, however, the defence by searchlight is not nearly so simple as it sounds. To begin with, a torpedo boat is an exceedingly difficult thing to hit at night; the searchlight beam serves to embarrass the gunner almost as much as it helps him. This is no doubt in a large measure due to the peculiar character of the arc light. The preponderance of blue and violet rays is well known, and the defects of the searchlight beam may be in a large measure attributed to their presence. If these rays could be filtered out, absorbed, or otherwise disposed of, leaving the red and yellow end of the spectrum largely predominating, the task of the gunner would be rendered very much less difficult. At present the effect of a searchlight beam thrown on a torpedo boat is that to a gunner placed behind or nearly behind the projector the boat appears as a white phantom, moving in a luminous fog amidst a number of scintillating points of light.

The white fog is caused by the reflection from various particles of dust and moisture in the atmosphere; a breaking wave top, passing bird, or spray at close quarters causes flashes of bright reflected light far more conspicuous by contrast than the rather indifferent reflection of the distant boat itself.

Of all the rays given out, the blue ones and those of shorter wave length are the most easily absorbed, and consequently, those that have travelled as far as the torpedo boat and have been reflected back are very much weaker than those which have travelled out only as far as the dust particles and returned the shorter distance.

The effect is to reduce the contrast between the large volume of reflected light arriving from the boat, and the smaller volume of brighter light reflected from the atmosphere. If we could employ a red beam, this contrast ought to be a good deal more marked; the reflected rays would suffer far less from absorption, and the greater volume of reflected light from the boat would make a more conspicuous target. The effect upon a gunner placed at some distance from the projector is not so unfavourable; here he has not to contend with a luminous atmosphere, he sees the beam as a broad white band with the torpedo boat as a white phantom in the midst of it, or at its extremity; but the phantom form is somewhat relieved by shadows where it has intercepted the light. The evil is, however, only mitigated, the eye adjusts itself to contrasts, and the most striking ones are the broad effect of light and shadow on waves and sky. There is another cause of error which is due to the high refractive power of the smaller wave lengths, making the boat appear to be in a false position, and this effect varies greatly with the state of the atmosphere.

Another disadvantage, and a very grave one from a war point of view, is the bright beam thrown by a searchlight in its path, and visible in all directions.

A fleet expecting torpedo boats to be in the vicinity is loath to use its searchlight defence until the very last moment; the switching-on of a single searchlight to prove if a suspicious object is really a torpedo boat or not, or to decide the reality of an imagined one, at once gives the position of the fleet away to the enemy if they be within its radius of vision, and would, of course, precipitate an attack.

Now, were the light polarised, the beam would be hardly luminous at all as a beam of light, while it would serve to illuminate the object on which it was directed equally well.

The reason for this is, of course, that the polarised light striking many particles in the atmosphere at an angle approaching the value of the polarising angle can only be reflected to a very imperfect extent, while that which returns from the torpedo boat has experienced reflection at an angle in no way approaching that of polarisation.

Putting aside polarisation, however, which introduces a number of complications, it would appear that the efficiency of the arc light as a defensive weapon would be very much increased by the suppression of the violet end of the spectrum. To some extent, no doubt, the blue rays could be suppressed by employing, instead of the silvered mirror, a reflecting surface that would only reflect the longer wave lengths. The solution of the difficulty appears, however, to lie more in the nature of the light emitted by the arc itself, and an orange light, such as is now obtained in many arcs used for illumination, would seem to be worth experimenting with.

SELLING JUICE.

An engineering canvasser or agent should not lay himself out to be a humourist, but he should certainly be provided with a keen sense of humour, if his temper is not to suffer on many occasions.

He should be a character reader, and his capital should be a good memory, a patent indexed mind capable of turning out seemingly good advice on all subjects, from an installation valued in the thousands to the best treatment for babies with whooping cough! All that comes between these limits or is in any way related thereto comes in useful. One may book what eventually turns out to be a modern cooking installation and a decently "pointed" lighting installation, by simply bringing an electric milk heater before the unsuspecting, when giving invaluable—at all events harmless—advice on the subject of babies.

Some men one has to treat on the American plan, with its sub-divisions to suit different temperaments; some have to be treated with absolute plain facts in short time and nothing else—"You'll save so much a year, as I've shown in this letter; won't keep you now—my telephone number is 100 National when you want me. Good morning." Others there be who like a bit of the braw laddie's dialect to put their minds in tune with the proposition. Others, again, naturally prefer just a hint of ould Erin's brogue to harmonise their mind waves. So our canvasser has to be able to sort t'other from which instantaneously, to know what language to speak!

Just to show the results of this kind of study, one man was found to be taking a shop on a certain day—different things prevented our canvasser from tackling him before the eventful date, and so something drastic had to be done. A "feeler" or "clinical" letter was sent him at about 10 a.m., messenger to wait for reply—which was negative. Letter No. 2 was specialised to the character indicated by the reply, and went at 11 a.m., the canvasser following within half-an-hour. No. 2 letter was from the "follow up" selection mild, the canvasser had his clinchers all ready in response to the second "No," with the result that by mid-day the application was signed, sealed and delivered, and the shop was wired and connected up by the following night.

Several consumers are ready enough to carry out suggestions of the supply station staff up to a certain point, and beyond that point they seem to think that their contractor will give them better service. Now the contractor lives by what he sells and the amount he wires, and, therefore, the consumer can be easily persuaded that he is doing a good thing for himself at the expense of the station, whilst in reality after a short time it proves that he has, as the canvasser prophesied, done a good thing for himself, but the station has scored all the same.

For instance, one consumer was interviewed on the subject of more efficient lamps, the proposition being to light up two premises, the total current cost not to be increased beyond the amount he was already paying. Americanism fetched him, and he sent to his contractor to have the work done. As a result he is now, of course, obtaining higher efficiency, but instead of the previous mixture there are now two electrically illuminated windows and shops, so that he who runs may read the moral, and the revenue has gone up, thanks to the contractor. Of course the canvasser's proposal was quite feasible, but contractors are not often illuminating engineers, and therefore they require more lamps to bring about the same effect.

The necessity for possessing the saving sense of humour is shown by the following yarn—the origin of which is claimed by several engineers in the Yorkshire district, I believe:—

A certain firm possessed a very fine mill on which electrical contractors cast longing eyes. Many representatives called to point out the inevitable large profit that the manufacturer would reap if only he would consider their scheme of electrification, but each came away with a feeling of having run his head against a big thick wall. One firm, however, who prides themselves on having men to suit all tastes, determined to pluck the plum, and so at what they considered the psychological moment they sent their extra specialised expert Mr. A. The expert, of course, had unanswerable arguments for everything, cut and dried, and filed in his mind, and could discuss to the utmost decimal place the increased output resulting from steady shaft turning moments.

Well, the expert called, was received by the same impassive gentleman standing within a few feet of the office door (the kind of man whose attitude suggests that there is only just room for the caller to twist round the door and shut it behind him), and focused his persuasive powers forthwith full bore. To his delight the owner receded, and even sat down to consider the statements—that was one better than the other representatives had gone. His arguments, persuasions, and clinchers got scarcely a reply beyond monosyllables, and after a time, as they say in the "Profession," he was nearly "dried up"; then the owner asked to be excused if he rang for his junior partner. "Delighted," of course, and so the junior partner came in. All arguments were by request again gone through, with additions and further clinchers, and once more the "dried up" stage was rapidly approaching, when the senior partner, turning to the junior, said, "Now, that is the way I want you to talk to people you go out to see. Good morning, Mr. A."!!!

Flux for Aluminium.—The high rate of oxidation of aluminium when melted is well known, and, owing to the small difference in specific gravity of the metal and oxide, the two form a thick pasty mass, which causes much loss in skimming. Early attempts to use a flux were unsuccessful, the chief difficulty being that the crucible was attacked. Charcoal is used with advantage in copper melting, but is harmful when tried as a covering for melting aluminium, for particles become mixed with the very light metal and the casting is damaged. Sometimes common salt is thrown into the pot in order to segregate the oxide, but salt melts with difficulty, and its effect is said to be only partly efficacious. Chloride of zinc has been used with excellent results, the aluminium being melted in the ordinary manner and removed from the fire before the flux is added. The quantity of chloride of zinc required is small, and the temperature to which the metal must be reduced before the flux is added is determined by practice. When it is thrown in, considerable smoke is given off, and the metal should be stirred well. The surface will be found quite clean, and covered with a dry, fine powder. This oxide of aluminium is skimmed off easily, and the metallic zinc which remains from the reaction becomes mixed with the molten metal. The *Railway and Engineering Review* suggests that the flux should not be added until the metal is ready for pouring, and states that the castings made from aluminium thus fluxed are cleaner and stronger than when no flux is used. In another issue of the same journal there is a note that one of the causes of pin-holes in aluminium castings is that the metal is allowed to remain in the furnace for some time after melting. If a good casting is desired the metal should be removed directly it has melted.

Efficiency of Small Generating Sets.—Some tests were recently reported in *La Revue Industrielle* in connection with the relative merits of the reciprocating and turbine types of engine for small powers—500-1,000 H.P. A Brown Boveri-Parsons turbine of 400-450 KW., running at 2,700 R.P.M., was pitted against a Sulzer compound engine of 600 H.P., running at 120 R.P.M., and driving two dynamos. Both sets were working under very similar conditions; and it was found that the consumption of steam per H.P.-hour was represented by two parallel curves, showing clearly in favour of the reciprocating engine so far as this factor was concerned. Of course, many other important considerations must be taken into account in selecting such plant.

AMERICAN TELEPHONE STATISTICS.

The following is the preliminary report on telephones issued by the Department of Commerce and Labour, Bureau of the Census:—

CONTINENTAL UNITED STATES

(Exclusive of Alaska, Hawaii, Philippine Islands, and Porto Rico).

The statistics relate to the years ending December 31st, 1907 and 1902. The totals include reports of all commercial and mutual systems and farmer or rural lines, but do not include reports of telephone lines operated by steam and electric railways; nor do they include reports of isolated systems operated exclusively for the benefit of commercial and manufacturing enterprises, Federal, State and Municipal Governments.

	1907.	1902.	% inc.
Number of systems and lines*	22,971	9,136	151·4
Miles of single wire	12,999,369	4,900,451	165·3
Number of stations or telephones, total	6,118,578	2,371,044	158·1
Bell (American T. & T. Co.)	†3,132,063	1,317,178	137·8
Independent (non-Bell)	2,986,515	1,053,866	183·4
Number of public exchanges	15,527	10,361	49·9
Number of switchboards, total	16,065	10,896	47·4
Common battery system	2,146	887	156·4
Magneto system	13,801	10,005	37·9
Automatic	118	54	118·5
Est. messages or talks during year, total	11,872,605,063	5,070,554,558	124·3
Local exchange messages	11,119,867,172	4,949,849,709	124·7
Long-distance and toll messages	252,787,891	120,704,844	109·4
Total income‡	$184,461,747	$86,825,536	112·5
Total expenses (including taxes, interest, and fixed charges)	$140,802,305	$65,164,771	116·1
Total cost of construction and equipment, including real estate and telephones	$819,667,008	$389,278,282	110·6
Capitalisation:—			
Capital stock authorised, par value	$1,121,931,023	$384,534,066	191·8
Capital stock outstanding, par value	$512,685,265	$274,049,697	87·1
Dividends on stock	$23,733,670	$14,982,719	58·4
Bonds authorised, par value	$556,537,932	$158,099,094	252·0
Bonds outstanding, par value	$301,930,739	$73,981,861	308·1
Interest on bonds	$12,316,109	$3,511,948	250·7
Total par value stock and bonds outstanding	$814,616,004	$348,031,058	134·1
Employés and wages:—			
Salaried employés, number	25,298	14,124	79·1
Salaries	$19,298,423	$9,885,886	95·5
Wage-earners, average number	118,871	64,628	83·9
Wages	$48,980,704	$26,369,735	85·7

* The statistics of farmer or rural lines included in this report are confined to number of lines, miles of wire, and number of telephones. 1907: 17,702 lines, 426,294 miles of wire, 565,649 telephones; 1902: 4,985 lines, 49,965 miles of wire, 55,747 telephones. It is probable that a more thorough canvass was made of these lines in 1907 than in 1902, which accounts in part for the large increase.

† Exclusive of 85,287 farmer or rural stations receiving exchange service through switchboards of "Bell" Companies. A large proportion of these stations were reported as and included in total stations for independent (non-Bell) systems.

‡ Includes assessments of mutual systems.

The final report for 1907 will contain an analysis of the above totals and present detail statistics for other phases of the industry.

The Porcelain Ware Syndicate.—An abstract of a circular issued by the International Syndicate for the advancement of the manufacture of electro-technical porcelain wares, of Berlin-Steglitz, has been given publicity by one of the recipients of the document. The circular begins by stating that the syndicate has now again reduced its prices for certain manufactures so low that it is in general capable of competing with outsiders, so that customers need no longer be dependent upon the latter for supplies when placing orders. But the presumption for the granting of the reduced rates is the signature of a declaration on the part of the subscribing customer that he will undertake in future to procure the whole of the goods required exclusively from members of the syndicate. Those clients who are unwilling to assume this obligation will be charged an increase of 20 per cent. on the syndicate prices for all new orders entrusted to constituents of the combination, and they will also receive no premium on the turnover. The practice suggested by the circular is not new in so far as concerns the extra charge to those firms who purchase both syndicated and non-syndicated goods, although the obligation sought to be imposed upon customers bears no time limit whatever.

Dissolution of the German Cable-Makers' Syndicate.—The syndicate of cable manufacturers in Germany, according to an announcement issued by the management, was dissolved on February 4th, this being the second combination of its kind to come to an end. It was in 1901 when the first syndicate of makers of cables for lighting and power purposes was brought into operation, and it lasted until August, 1903. An interregnum then took place, and this was followed by the constitution of a new syndicate in 1904 for a period of years ending with 1910. A new cable factory has recently been brought into existence, and although the proprietary company was prepared to join the syndicate the claims put forward in regard to the desired share in the business were considered out of the question by the combined makers, who consequently resolved to dissolve the organisation in order that each individual member may be at liberty to compete on his own terms with the new rival who intends to make a cut for the business.

PROCEEDINGS OF INSTITUTIONS.

The Use of Large Gas Engines for Generating Electric Power.

By LEONARD ANDREWS, M.I.E.E., and REGINALD PORTER, B.A., A.M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London and Dublin, on February 11th, and at Manchester, February 16th.*)

In Germany the manufacture of large gas engines is an established industry on a large scale. Even in 1906, out of 49 smelting works 41 had either installed gas engines or had placed orders for them, the engines actually installed at that time aggregating over 295,000 H.P. Whilst there have been a few blast-furnace gas engine installations working in this country for some years, the engines used have been mainly limited to capacities of from 300 to 500 B.H.P., and credit must undoubtedly be given to the German iron and steel industry for having created the demand which has brought the large gas engine to its present state of perfection.

The use of large gas engines for driving electric generators is a subject that is also receiving considerable attention in the United States, and there are to-day installed and building in that country at least 300,000 H.P. in large units.

Whilst the authors believe that there is an important field for the use of large gas engines for driving electric generators, they do not consider that there is at present justification for the suggestion

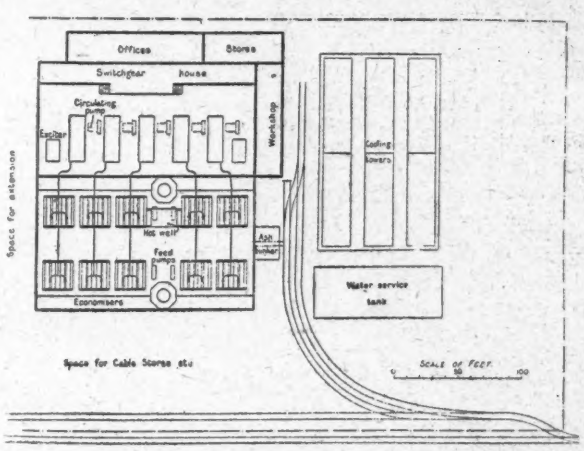


FIG. 1.—10,000-KW. STEAM PLANT (PLAN).

that has been made, that the internal combustion engine will, in the early future, be used to the exclusion of the external combustion engine. The position may be briefly summarised as follows:—

The internal combustion engine is very much more economical than any external combustion engine yet known.

The capital cost of a gas engine and producer installation is greater than that of a steam turbine and boiler installation of equivalent overload capacity.

There is no material difference in the reliability or in the cost of labour, stores, and repairs of the respective systems.

In cases, therefore, where the cost of fuel is low, and the load factor is low, it will generally be a mistake to use gas engines. On the other hand, where the load factor is high, or the cost of

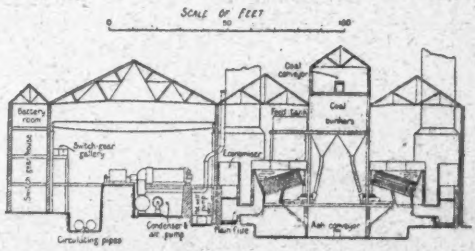


FIG. 2.—10,000-KW. STEAM PLANT (ELEVATION).

fuel is high, there can be no doubt that gas engines will prove to be by far the cheapest prime mover to employ for driving electric generators.

For comparative purposes the authors have endeavoured to show what, in their opinion, would be the respective total costs of generating power by steam turbines and by gas-driven generators in concrete cases, assuming first that the estimated maximum load to be dealt with shall be 8,000 KW.; that the overload and stand-by capacity of the plant shall be such as to carry the maximum load for at least two hours, should any portion of the plant break down at the time when one unit is already laid off for overhaul; that the

power generated is utilised for public and private lighting, and for a tramway and general industrial motor load; that the load factor equals 24 per cent.; that the efficiency of distribution equals 80 per cent., with a given mean daily load curve; and that the cost of good bituminous slack, having a calorific value of 13,000 B.TH.U. per lb., is 12s. per ton delivered at the generating station.

The points to be considered in selecting a site for a gas-driven station are practically the same as for a steam-driven station, viz.:—

(*a*) A plentiful supply of water for cooling purposes.
(*b*) Transport of fuel.
(*c*) Suitability of site relatively to position of centre of distributing area, as affecting cost of feeders.
(*d*) Liability of nuisance to adjoining property.
(*e*) Cheapness of land.
(*f*) Cost of constructing foundations for plant, buildings, and chimneys.

Since it is impossible to estimate the cost of obtaining a site with a plentiful water supply, as this will vary largely in every case, the

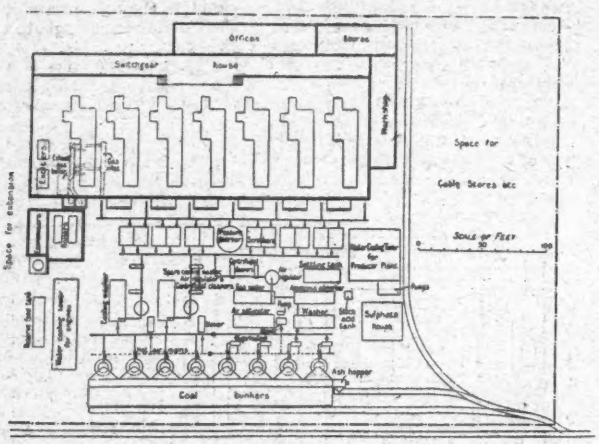


Fig. 3.—10,000-kw. Gas Plant (Plan).

authors have based their comparisons upon the assumption that cooling towers will be used in conjunction with a public water supply.

A convenient lay-out for the steam plant will be that shown in figs. 1 and 2. Figs. 3 and 4 show a corresponding lay-out for the gas plant.

For the steam plant, steam turbines of the horizontal type would be used directly coupled to three-phase generators, each turbine exhausting into a separate contra-flow surface condenser placed directly below it; the cooling water would be obtained from a town supply and circulated by electrically driven centrifugal pumps through natural-draught cooling towers, a separate pump being installed for each unit.

For the gas plant it has been assumed that the engines would be of the slow-speed, four-cycle double-acting tandem type, directly

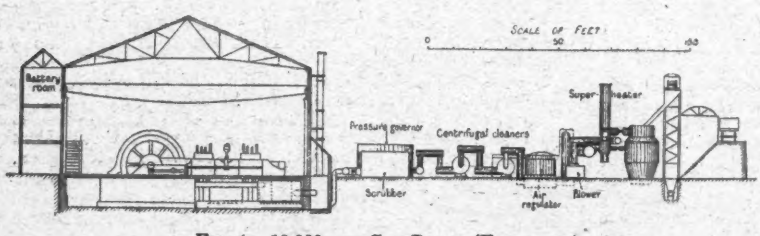


Fig. 4.—10,000-kw. Gas Plant (Elevation).

coupled to overhanging fly-wheel three-phase generators. The cooling water for the engines would, as in the case of steam plant, be obtained from a town supply and circulated by means of small piston pumps driven from the engine crankshafts, the water being cooled in natural-draught cooling towers.

For a maximum output of 8,000 kw. it appears that the most economical arrangement of steam units would be five sets, each having a normal capacity of 2,000 kw., with an overload capacity for two hours of 33⅓ per cent.

The output of gas-engine units is, at present, limited to about 1,500 B.H.P. per cylinder. For the gas scheme it does not appear to be advisable to use even such large units as 2,000-kw. sets, since the overload capacity of gas engines is only 10 or 12 per cent.

A more economical installation would consist of seven generators, having a normal capacity of 1,450 kw. each, and an overload capacity of 1,600 kw.

The only advantage of the twin-tandem over the single-tandem combination appears to be that, with a four-cycle engine, the crankshaft will receive four impulses per revolution instead of two. It is obvious, therefore, that, with a given fly-wheel effect, the cyclic irregularity will be considerably greater with the latter than with the former.

The per cent. variation above and below normal of engines fitted with a fly-wheel constructed for a tandem double-acting engine having a speed variation of 1/250 is as follows:—

Double-acting twin tandem	0·02 per cent.
Double-acting single tandem	0·2 ,,
Single-acting tandem	3·1 ,,
Double-acting single cylinder	4·5 ,,

The capital cost of a twin-tandem set is appreciably higher than that of a single-tandem set of the same output. The cost of fuel, oil and repairs will also be slightly higher, and the cost of drivers' wages for the twin-tandem will be practically double that of the single-tandem set, as experience has shown that one engine-driver is required for each line of engines, whatever the output of the engines. It appears, therefore, that, for the conditions under discussion, a single-tandem engine is the best type of plant.

In calculating the boiler capacity, we have assumed that the steam consumption of the turbo-generator under working conditions, including the steam for feed pumps and exciters, would be 20 lb. per kw. generated. We have therefore provided for four 10,000-lb. boilers for each 2,000-kw. turbine. An economiser is provided for each boiler.

Whilst the development of large gas engines has been more pronounced in Germany than in this country, England has done much more in perfecting the producer end of the problem. There are numbers of bituminous producer installations in this country working entirely satisfactorily in conjunction with large gas engines. One firm of English producer makers alone has at the present time various plants supplying gas to large engines having an aggregate output of over 90,000 B.H.P. From information obtained from users, it appears that these producers are giving entire satisfaction.

With properly designed engines there appear to be no greater difficulties to contend with than when working on blast-furnace gas. The comparatively high percentage of hydrogen tends to cause pre-ignition if the compression is carried to too high a point. This difficulty is, however, entirely removed by constructing the engines for a lower compression.

The difficulties experienced in the early days in the removal of tar, dust, and other impurities have been overcome by the efficient cleaning appliances now included in every properly constructed producer plant.

Difficulties arising from variations in the quality of the gas caused by charging or clinkering the producers practically disappear when a number of producers are connected together to feed into a common main, and therefore the producer plant should not be divided into units corresponding to the generator units.

The following points must be taken into consideration as affecting the use of ammonia recovery plants:—

1. The first cost of the recovery plant, particularly for small sizes, is very much greater than the first cost of non-recovery plant.
2. Considerable extra labour is involved in operating the plant.
3. The purchase of sulphuric acid, of which approximately 1 ton is required for every ton of sulphate of ammonia turned out, is quite a heavy item.
4. The yield of heat units per ton of coal is slightly less if sulphate of ammonia is recovered than the yield from non-recovery plants.
5. The extra cost of repairs and the cost of handling and packing the by-product absorb some of the profits effected by the recovery process.

It is not worth while to attempt to recover sulphate of ammonia unless the total output of the plant is greater than 2,000 horse-power, and then only on an exceedingly good load factor.

For a maximum output of 8,000 kw. it would probably pay to put down ammonia recovery plant, even for so poor a load factor as 24 per cent. It is better to provide for ammonia recovery on one portion of the plant, which could be kept working at a very high load factor almost continuously, and to use non-recovery plant for dealing with the peak load and remaining portion of the total output. For the particular conditions now under discussion, the Power Gas Corporation recommend the use of eight producers, of which four would be equipped for ammonia recovery and the remaining four for non-recovery.

For both the steam and gas plants we have assumed that coal bunkers will be provided capable of carrying a fortnight's consumption of fuel under mean load conditions.

In the case of the steam plant we have assumed that the coal bunkers would be placed over the firing floor of the boilers. These bunkers would have a capacity of 1,500 tons.

In the case of the gas plant the coal would be stored in bunkers placed on the ground at the back of, and parallel with, the producers. It would be delivered to the hoppers over the producers by a conveyor, which would also remove the ashes.

The cost of the engine room and engine foundations for the gas-driven plant is considerably greater than that of the steam plant, but no building is required for the producers (beyond small boiler and sulphate houses) and the cost of the foundations for the producers is very small compared with the cost of boiler foundations, flues, chimneys, &c. The total cost of buildings amounts to considerably less, therefore, for the gas station than for the steam station.

For both the steam plant and the gas plant the field circuits of the generators would be excited from bus-bars fed by two steam-

driven exciters, each capable of generating the whole of the exciting current required on full load. The exciters would be supplemented by a battery capable of maintaining the full field current required for a period of 24 hours.

In the case of the gas plant the steam for the exciters would be furnished by one of the small coal or tar-fired boilers installed for this purpose. The exhaust steam from the exciter engines would be used in the producers, any additional steam required by the latter being raised by boilers heated by the exhaust gases from the main engines.

The switchgear would be of the remote control type, the oil-break switches being placed in a switch-room running the length of the engine room.

The total capital cost of the respective steam and gas plants for the specified maximum load of 8,000 kw. will, we estimate, be as follows:—

Steam Plant.

Five 2,000 kw. turbo-generators, erected complete ...	£39,500
Five surface condensers with air and circulating pumps	9,875
Circulating pipes	1,200
Cooling towers erected complete	6,900
Twenty water-tube boilers erected complete with mechanical stokers, economisers, superheaters, feed pumps, water service tank and feed tank, water softening plant and all pipe work	31,300
Buildings with engine and boiler foundations, two chimneys and flues	33,600
Overhead travelling crane	1,000
Steel structural work, coal bunkers, coal and ash-conveying plant	8,900
Exciters, battery, switchgear, and connections to generator	7,250
	£139,525

Or £13·952 per kilowatt installed.

Gas Plant.

Seven 1,450-kw. gas engines, generators, air compressors, gas, water, air, and exhaust pipes and all auxiliaries erected complete	£98,000
Four ammonia-recovery producers, erected complete with superheaters, blowers, cooling and washing towers, centrifugal cleaners, scrubbers, ammonia absorber, and all pipe-work	18,490
Duplicate blower, washer, and centrifugal cleaners ..	3,780
Four non-recovery producers with necessary scrubbers, &c....	10,340
Steam-raising plant, economisers, feed-pumps, &c. ...	4,850
Water cooling towers, pumps, and water softener ...	1,990
Buildings and foundations, &c.	24,275
Overhead travelling crane	1,250
Steel structural work, coal bunkers, coal and ash conveying plant	6,150
Exciters, battery, switchgear, and connections to generators	7,750
	£176,875

Or £17 68 per kilowatt installed.

(*To be continued.*)

The Public Supply of Electric Power.

By G. L. Addenbrooke, M.I.E.E.

(*Abstract of Paper read before the* Royal Society of Arts (Cantor Lectures, III) *on January 25th*, 1909.)

Outside town areas power supply has been carried out chiefly at pressures of 6,000 to 12,000 volts, and the Newcastle Co. has considerable lengths of cable working at 20,000 volts, three-phase. Lead-covered paper-insulated cables are always used; during the last 16 or 18 years this type has proved most satisfactory as regards durability and reliability, provided that the joints are skilfully made. The chief cause of failure is pressure surge due to resonance effects. Were these absent, the paper insulation could be made thinner and the diameter of the expensive lead covering diminished. The lecturer believes that, by careful study, resonance effects may ultimately be reduced to a negligible value. Overhead mains have only within the last few years been permitted in this country, though almost universal abroad; they cost only half as much as underground mains, are used up to 30,000 volts in this country, and are more easily maintained than the latter. Cables should be looped into factories in preference to making T joints, to facilitate repairs.

Great improvements have been effected in transformers during recent years, the efficiency being very high and the cost from £2 per kw. in small sizes to 10s. in large ones. It not infrequently pays to transform twice when supplying small consumers, reducing the pressure at a sub-station from 20,000 or 10,000 volts to, say, 3,000 volts for distribution; this simplifies the switchgear and avoids complication of the main high-pressure circuits.

The supply of energy to a distributing system by subsidiary power stations presents important advantages, such as the utilisation of waste heat and the reduction of cost of the distributing system.

It is very important to provide for the immediate localisation of faults on the mains by the use of either time-element cut-outs or balanced transformers. The Merz-Price system of the latter type is the most complete, and, in the lecturer's opinion, will be adopted on complicated networks in future, as it has the great merit of cutting out the faulty section only, though it is expensive, as it necessitates the use of a small three-core pilot cable between sub-stations. For circuits of less importance, automatic cut-outs are now fitted on the oil switches without the intervention of series transformers.

Much depends upon the design and proper operation of switchgear in sub-stations and on consumers' premises, a rather expensive item, the standardisation of which would be a most desirable improvement. The Reyrolle type of switchgear presents special advantages in the shape of compactness and safety.

The use of electric motors in factories supplied from public stations in the U.S.A. is at least double what it is here, so that there is a large opening for increase in this respect. The industry in which the substitution of electric motors for mechanical driving has always been considered the most difficult is the textile industry; nevertheless, the gain in regularity of rotation of the motor at all loads is very important, enabling machines to be run 5 or 6 per cent. faster without increasing the cost of attendance. Electric driving is also being applied to main haulage for collieries and the driving of rolling mills. Single-phase motors which can be fed from one phase of a three-phase supply, and can be made to vary their speed 50 per cent. by moving the brushes on the commutator of a short-circuited armature, have recently been developed, and remove one of the last objections to the use of alternating currents.

Looking to the future, there is no probability of any serious rival to public electric power supply entering the field. There is room for improvements in the power station plant; the lecturer considers that while gas engines and producers may be made sufficiently reliable and suitable for use in central stations, the expenditure of an equal amount of ingenuity and skill on steam plant would produce an economy of 25 per cent. over the best present-day practice, and the conditions obtaining in large central stations nowadays are more favourable to the practice of economy than formerly. No time must be lost, however, lest the fashion should change in favour of the gas engine. The chief obstacle to the use of the latter lies in the difficulty of obtaining thoroughly satisfactory producers and cleaning plant, to work with bituminous coal. Were these obtainable, it would not be long before the gas engine was working in parallel with the steam turbine and taking the more continuous part of the load in power stations. The cost of labour, oil and stores, and repairs would probably be considerably increased if gas engines were used; the saving would be in coal, and might reach 40 per cent., resulting in a net reduction of 10 per cent. in the cost of energy with ordinary load factors, and 20 per cent. where the load was continuous, with coal at the prices obtainable in industrial areas. Away from the coalfields the saving would be greater. But the cost of gas plant and buildings is at present 25 per cent. greater than that of steam plant, and the low-speed gas engine with small overload capacity is inferior in suitability to the steam turbine, so that at present gas driving offers little advantage in districts where coal is cheap. It will probably come into use first where much power is used and coal is dear, working in parallel with steam plant and taking the long-hour load. The chances are that in the long run it will win the race, probably by the use of multi-cylinder high-speed engines, the economy in coal being sufficient to give the shareholder a fair dividend instead of a meagre one. The danger of committing a nuisance by the manufacture of producer gas on a large scale must not be overlooked.

The fact that power and lighting supply necessitates the crossing or use of roads renders the industry absolutely subject to legislation, which may defeat the best engineering and commercial proposals or indefinitely delay their execution and lead to much expense. To obtain powers for lighting supply it is necessary to proceed by prov. order under the Electric Lighting Act of 1882, in addition to any powers obtained under a Power Act; when such an order is obtained by a third party it enables competition in power supply to be set up, while if a power company does any lighting under it, it is uncertain how far the company's system becomes purchasable under the purchase clause of the Electric Lighting Act unless the two systems of distribution are kept quite separate, a needless expense and complication. Again, the impossible scheme of finance forced on the Power Companies by Parliament is absolutely unsuited for an undertaking of this character; it has led to the curious result that in the case of most of the power companies another limited company has had to be formed to hold the Parliamentary company in trust, entailing heavy expenses. The absolute veto of the local authorities is another great obstacle to development, but the chief difficulties are the Act of 1882 and the modified purchase clause of 1888. The unit area of supply is usually the area of a local authority; there are numbers of towns and districts without a supply, which can only be dealt with profitably on the basis of a combined power and lighting supply, comprising many industrial areas, and in all these cases the incidence of the purchase clause bears very hardly, no matter what the nature of the district.

From the figures already given it will be seen that the gross revenue of supply undertakings when fully in operation will probably be less than one-fifth of the capital expended; but usually capital will have to be expended in advance of requirements, and on the average the capital in successful undertakings will be turned over only once in seven years, or six times in the 42 years which constitute the term of the concession under provisional orders. The purchase price would probably not exceed 60 per cent. of the capital, so that besides allowing for depreciation and contingencies, a sum of 40 per cent. of the capital must be accumulated, while the capital is only turned over about six times in good districts, and four or five times in poorer districts. Recent proceedings have shown that the terms of the purchase clause are too severe even for wealthy districts, and in

the smaller and poorer districts it is a heavy handicap. If the terms of the concession are not improved, the adoption of lighting and power supply in suburban districts and country towns will be greatly delayed.

Again, under the provisional order regulations, the procedure covers a year, and it may often take 2 to 2½ years to commence operations; these long delays tire out commercial men, who expect some result within a year or so. There is no reason why the procedure should not be assimilated to the light railway procedure, which permits application to be made twice in the year. In several European countries the procedure is such that the whole negotiations need only occupy a few weeks, or at the outside three or four months. In this country the result of legislation has been to set private and municipal enterprise in opposition, instead of rendering them mutually helpful, as is the tendency abroad.

In view of the magnitude and importance of the supply of electrical energy in the economic, commercial and social life of the future, the lecturer hopes that what he has said may induce legislators and others to treat the questions which are arising in the working out of this great problem with the attention which it deserves.

The "G.B." System of Traction.

(*Discussion at Leeds, January 27th. For abstract of the paper see* Electrical Review, *January 29th*, 1909.)

Mr. W. M. Rogerson, in opening the discussion, said the surface contact system at Lincoln had only been running 2½ years, and the comparative figures with other systems were not quite accurate, because after a system had been running for something like six or seven years the expenses in maintenance increased very rapidly. It must be remembered that the route was practically flat, and therefore the comparisons made, especially with districts such as they had in the North, were hardly equitable. It would be interesting to know whether the maintenance charges given in the paper included the renewal work that had been done by the G.B. Co.—that is, new cable and repairs and maintenance of the batteries and contacts—as, if not, the figure was not a correct one. Mr. Clegg referred to the silent running of the cars. Later on, he thought that Lincoln would suffer as badly from noise as any other system, as it was generally the gears and various other parts of the cars, as well as the permanent way, which in time got worn, and so set up various noises which did not occur in the first few years of the life of the equipment.

Mr. W. N. Y. King said the comparison which the author had made was between the total costs of the G.B. system and the overhead system. As a matter of fact, the costs that were peculiar to the two systems were only a small proportion of that total; the greater proportion was common to the two systems. Of 19 municipally-operated overhead systems which had been running for three years or less, the average cost for repairs and maintenance was 79, against the corresponding figure on the Lincoln system of 1·251, which showed a saving in favour of the overhead system of 37 per cent. It appeared that the leakage from the G.B. system was considerably higher than that obtained on an overhead system. On the speaker's system they got about ·02 to ·2 ampere; if it got beyond that the feeders were tested separately, but so long as the insulation on the G.B. system kept about constant, he thought it was not a very serious matter. There were, however, certain points about the system which would be much worse in towns where there was a continuous road traffic. He thought that in hot weather the bitumen would be apt to get soft, and the heavy traffic would have the effect of driving the studs down into the ground and upsetting the adjustment of the contact maker. The system itself was a very excellent one and compared with any other surface-contact system, a great advance in simplicity and cost of construction; it, perhaps, equalled the overhead system in reliability and safety.

Mr. J. J. McMahon (communicated) said, from the author's description, it was fortunate that the G.B. system was first tried on a very small scale, on level lines with few junctions and very little traffic, as the methods described would never be tolerated on a large and busy system. Something must be done in order to avoid the necessity for the pulling and turning of the cable mentioned, and the cable itself would be useless in a corrosive atmosphere. It ought to be a simple matter to clamp some form of copper or gun-metal seating on the cable at each contact point, and so eliminate all damage to the cable. The method adopted for detecting live studs would not be acceptable on a busy city line, as a car would run on for 20 yards or more after leaving a live stud, and there was generally a hansom or line of fast-moving vehicles following up the car. As regarded dangers from the wires, in Manchester there had been only five wires down during the past five years, and the wire could generally be seen and avoided. During the period August 24th, 1907, to September 7th, 1908, there were 40 live studs at Lincoln, and this meant that against the five live wires down, Manchester would have had *pro rata* something like 20,000 live studs had it been equipped with this system.

Mr. W. J. Benton said, with regard to the comparative costs of the systems, he thought they might be reduced to items for repairs and maintenance only, as where the trouble was likely to arise was in the studs. As to the springs being a source of trouble, springs as made to-day were very reliable articles; in springs used in governors breakages were very uncommon. The little connection from the moving piece to the stud appeared to be more likely to get out of order. He questioned whether any surface-contact system would lend itself to relaying, as did the overhead system, with a temporary line laid alongside.

Mr. H. E. Yerbury said he would like to ask the author whether he included in his insulation resistance test the insulation of the internal magnet in addition to the cable. As far as he could see that would have to be taken separately in this system. It appeared to him that they had another instance of an undertaking which was entirely satisfactory in a town where the conditions were ideal for such a system.

Mr. C. E. C. Shawfield said the author contrasted the G.B. system with the overhead system, and said that it fulfilled the requirements of low maintenance costs, reliability, safety, silent running and sightliness, and he (the speaker) was of opinion that this could be said of any good surface-contact system. The G.B. system in Lincoln had been running for some three years, and proved itself to be at least as safe as the overhead system; it was certainly more sightly, and the claim of silent running would be admitted by all who had inspected it. As regarded reliability, it might almost be said that even a second-rate surface-contact system was superior to the overhead system. A previous speaker had said that failures of the overhead equipment were rare, and it was equally true that in a well-designed and well-installed surface-contact system they did not exist. During seven years' running on 20 miles of track at Wolverhampton, not one second's delay had been caused by any failure of the Lorain track equipment. On one route on the Wolverhampton system, the current consumption came out at practically the same as the lower figure given by Mr. Clegg; all the other routes in the town were of a hilly character, and the current consumption thereon was considerably higher. The average current consumption per car-mile at Wolverhampton was 1·6 units, as against 1·2 units for the flattest route. He did not regard the G.B. as the best surface-contact system, as there were certain points in its design which he thought incorrect, and various details in connection with the installation might well be bettered. The life of the carbons on the G.B. system seemed to be extremely short; the maximum life expected in future was only about five years. There appeared to be no practical difficulty in interposing a second carbon between the iron cable and the upper carbon, which might do away with the possibility of the carbons sticking to the iron cable, and with the wear of the carbons. His experience with carbon contacts on the Lorain system was that they were of an extremely durable character. The renewals of the carbon contacts due to burning or breaking were about one per annum out of some 11,000 studs in operation. Carbons that had been in constant use on a 2½-minute service in the centre of the town for seven years, were practically as good as when they were put in. If a carbon contact were fixed on the G.B. cable itself, wear and tear on the cable would be done away with, and there would be no necessity to move it periodically; it might then be laid solid in an earthenware trough. He did not see why the operation of the contact should not be reversed, so that instead of the magnetic field pulling the sliding piece down on to the cable, that piece might be electrically connected to the cable and be pulled upwards against gravity. As regarded the question of safety, with the single exception of the conduit system, a surface-contact system was the safest form of electric traction now in operation. For the year ending December 31st last there were 52 live studs in Wolverhampton over 20 miles of track, giving an average of 2·6 studs per mile of track per annum. No attempt was made to locate these defective studs by means of any apparatus carried on the cars, and they were usually found in the course of the ordinary inspection and testing. It might be interesting to note in this connection that all the inspection, testing, repairs and maintenance of the 20 miles of the Lorain track equipment were carried out by three men.

Mr. J. F. Fawcett said, as far as heavy traffic was concerned, Lincoln got a fair share of it; it resembled a manufacturing town more than a cathedral city, as there were a great many traction engines and lorries about. In towns where the overhead system was in operation they kept tower wagons in the streets, which were not there for ornament, and he thought the trouble was no greater than with the overhead equipment.

Mr. W. Griffiths said that the permanent-way maintenance was for 12 months, whereas the upkeep of this system was guaranteed for 10 years—viz., that the cost of maintenance should not exceed £30 per mile of track per annum. With reference to the renewals, the only thing that was done by the contractors was to reinstate the cable and also rectify the damage that was done to the studs by the stranded cable, as was pointed out by the author.

Mr. B. H. Bedell said one very interesting point had been raised—viz., that of "gravity control" for stud switch mechanism. It had been said that gravity was superior to spring action for restoring the stud to its non-working position. At Lincoln there had been no cause to modify the spring portion of the equipment, and, quite apart from that, there was a very important reason why a spring was preferable to gravity control. With a spring it was easy to adjust the stud switch mechanism so that a state of equilibrium existed such that an infinitesimally small force would suffice to begin to close down the switch. With gravity control this advantage could not be secured, since gravity was a constant force, and therefore a switch piece which weighed 10 oz., when it was on its bottom seating, required to be acted on by a force of something over 10 oz. before it began to move. It was extremely difficult to devise a magnetic pull mechanism which would not very rapidly increase in strength as the iron parts approached each other. In all gravity control systems which had been devised, that defect existed. When the overhead system was first put in, stories used to be told of the difficulty in simply keeping the trolley on the line, even on a perfectly straight bit of track. This, of course, was something like 20 years ago, when it was in its infancy. He had tried many types of carbons made in this country and elsewhere, and the rate of wear with two carbons together seemed to be as

nearly as possible two-thirds greater than with one carbon and one metal contact. In the case of a double carbon contact there was practically no means of conducting away the heat generated at the point of contact. The wear on the carbons was caused by the occasional heating to redness of spots on the carbon face; these then slowly oxidised away. A certain amount of carbon was ground off by purely mechanical action. The galvanising was used as a protection for the iron, and if, as suggested, in some localities this was found to be insufficient by itself, there would be no objection to further giving the cable some coats of "bitumastic solution" or "ohmaline" or any other protective covering, since with 500 volts across it, anything of this sort would break down where required at the points of contact with the studs.

Mr. Stanley Clegg, in reply, said the wear on the original type of cable installed was due largely to the indifferent contact between the carbons and the stranded cable. The plain surface of the new cable had greatly obviated the excessive wear, as was proved by the fact that it was not now necessary to move the cables more than once every 12 to 15 months. The Lincoln cars weighed unloaded, exclusive of the "G.B." apparatus (itself 25 cwt.) from 8 to 8½ tons; he had personally driven them when it was not possible to see the studs, owing to the road being covered with a layer of mud; the chain, however, found them without fail. There was no likelihood of heavy traffic in the nature of traction engines, &c., forcing the studs down below the road level. The leakage test on a surface-contact system would naturally be greatly inferior to that of an overhead system. Ventilation could be easily managed by splitting the system up into sections, which could be ventilated separately, and also by the use of natural ventilation by means of ventilating columns. The amount of current required for starting and running the cars was in no way in excess of that on the overhead system. On starting on series, the ammeter showed about 50 amperes, settling down to 20, and from 60 to 70 amperes on parallel, settling down at 40. The current consumption would be smaller but for the fact that there were two railway crossings on the line, on each side of which there were Board of Trade stops, and also a somewhat excessive number of request stops. There had been practically no trouble with the carbons sticking to the cable, due to the "knock-off" action arranged in the stud switchpiece. He considered the new type of cable to be practically everlasting, as at the end of the 14 years new sleeves could easily be threaded on and the cable used over again. The force required to overcome the springs of the studs and bring the carbon down to the cable was 11½ ounces. He did not agree that in a properly ventilated conduit a galvanised iron cable would be rusted over in twelve months, no matter how bad the atmosphere of the place. The insulation test referred to by Mr. Yerbury was taken in exactly the same manner as with the overhead system, the line being charged, and all cars having their magnets unexcited, to correspond with the trolleys being taken off the overhead line, or, which came to the same thing, the car-shed being cut off the system. The test was, of course, the resistance between the live cable and earth, as the stud switchpiece could only be tested separately.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Compulsory Purchase" writes:—"Local authorities having power to acquire electric light companies' undertakings by Sec. 2 of the Electric Lighting Act, 1888, must pay the 'then value' of all lands, buildings, works and plant of such undertakings suitable to and used by them for the purpose of their undertaking, no compensation being made for compulsory purchase.

"Will you please explain how the 'then value' will be ascertained? As suggested on page 939 of your issue of December 14th, 1906, no precise meaning was then available. Perhaps you have arrived at a satisfactory solution in the meantime.

"Or is the capital expenditure, passed by the Board of Trade auditor, declared to be conclusive evidence of the 'then value' of the undertaking? If not, what useful purpose is served by the Board of Trade auditing such accounts?"

*** When dealing with the question of compensation for compulsory purchase, it is necessary to consider the provisions of Sec. 2 of the Electric Lighting Act, 1888. Unfortunately the provisions of that section have not yet come before the courts for discussion, as the date when local authorities may purchase compulsorily has not yet been reached. So far as can be understood from the Act itself, the capital expenditure passed by the Board of Trade has nothing to do with the matter. The Act provides that the local authority must pay "the then value of all lands, buildings, works, materials and plant of such undertakers suitable to and used by them for the purposes of their undertaking, such value to be settled by arbitration. The value is to be deemed the fair market value at the time of the purchase, due regard being had to the nature and then condition of such buildings, works, materials, and plant, and to the state of repair thereof, and to the circumstance that they are in such a position as to be ready for immediate working, and to the suitability of the same to the purposes of the undertaking, and, when a part only of the undertaking is purchased, to any loss occasioned by severance, but without any addition in respect of compulsory purchase, or of goodwill, or of any profits which may or might have been or be made from the undertaking, or of any similar considerations."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PROPOSED NEW FRENCH TARIFF.

The Customs Commission of the French Chamber of Deputies have for some time past been engaged in considering the question of the necessity of revising the French customs tariff, and have recently issued their report, in which recommendations are made for the amendment of certain sections of the tariff. The Board of Trade have just issued a translation of the French tariff, giving a comparison of the rates at present in force with the alterations which are proposed. The following details as to proposed changes in the rates for electrical and similar materials have been taken from this translation, but no mention is here made of those electrical and similar materials, the rates for which it has not been proposed to alter. The proposals have yet to be dealt with by the French Legislature, and may be still further altered before being finally put into force.

	Present tariff. Fcs. per 100 kg.	Proposed tariff. Fcs. per 100 kg.
Cement, slow	50	60
„ quick	25	40
Pipes and moulded articles—		
Of ordinary cement or concrete	1	1
„ reinforced concrete		2
Asphalt, rock and cement in cakes or powder	free	0·30
Slabs	free	1·50
Wire of iron or steel—		
Less than 60 kg. resistance per sq. mm. of section, and of a diameter of—		
More than 2 mm.	7	7
„ „ 1 „ and up to 2 mm.	10	10
„ „ $\frac{5}{10}$ „ „ „ 1 „	12	12
$\frac{5}{10}$ mm. or less	20	20
From 60 kg. to 130 kg. resistance per sq. mm. of section and of a diameter of—		
More than 2 mm.	7	12
„ „ 1 „ and up to 2 mm.	10	15
„ „ $\frac{5}{10}$ „ „ „ 1 „	12	20
$\frac{5}{10}$ mm. or less	20	25
More than 130 kg. resistance per sq. mm. of section of a diameter of—		
More than 2 mm.	7	20
„ „ 1 „ and up to 2 mm.	10	25
„ „ $\frac{5}{10}$ „ „ „ 1 „	14	50
$\frac{5}{10}$ mm. or less	20	60
Rails of iron or steel ordinary	6	6
„ of special steel, *i.e.*, into the composition of which enters either more than 5 per cent. of manganese or some other valuable metal		25
Copper, rolled or hammered in bars	10	8
„ „ „ plates—		
Of 4 metres or less in length:		
More than $\frac{1}{10}$ mm. thick	10	10
$\frac{5}{10}$ mm. or less thick		12
Of more than 4 mm. in length:		
More than $\frac{1}{10}$ mm. thick		12
$\frac{5}{10}$ mm. or less thick		15
Copper, in wire, polished or not, other than gilt, silvered, or nickelled, of a diameter of—		
$\frac{5}{10}$ mm. or more	10	10
$\frac{5}{10}$ „ „ but less than $\frac{1}{10}$ mm.		15
less than $\frac{1}{10}$ mm.		30
Incandescent electric lamps—		
With mountings	350	350
Without mountings	700	700
With metal filaments, with mountings	not specified	500
Steam engines, stationary and marine, without boilers, steam pumps, turbines worked by gas, petroleum, hot air or compressed air—		
Weighing 1,000 kg. or more	differently classified, see below	12
„ from 500 to 1,000 kg.		14
„ „ 200 to 500 „		20
„ „ 100 to 200 „		30
„ „ 50 to 100 „		40
„ less than 50 kg.		60
Steam engines, stationary and marine, without boilers, steam pumps, gas, petroleum, hot air and compressed air engines:		
Weighing 250 kg. or more	12	differently classified see above
„ less than 250 kg.	20	
Traction engines, steam	ordinary gauge, 15	15
Locomotives, petrol, benzine, spirit, &c.	narrow gauge, 18	18
Locomotives, steam and electric		21

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this Journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,380. "Improvements in telegraphy and telephony by means of Hertzian waves." F. J. CHAMBERS. February 1st.

2,395. "Improvements in electric accumulator sub-stations fed from alternating current systems." A. M. TAYLOR. February 1st.

2,574. "Electro-servo motors." M. COUADE. (Date applied for under Sec. 91 of the Act, February 25th, 1908, being date of application in France. Application for Patent of Addition to No. 3,927/07.) February 1st. (Complete.)

2,879. "Improvements in vents for use with electric accumulators, batteries and the like." W. CGWLEROY and REASON MANUFACTURING CO. February 1st. (Complete.)

2,883. "Improvements in apparatus for starting and controlling electric motors, applicable, for instance, to sewing machines." H. J. READ. February 1st.

2,389. "Improvements in methods of and apparatus for the treatment of electric lamp filaments." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 1st.

2,401. "Improvements in starting internal combustion engines." F. T. SIMMS and SIMMS MANUFACTURING CO., LTD. February 1st.

2,403. "Improvements in electric motor apparatus applicable to machinery of all kinds requiring force." T. J. HOWELL and E. J. RICHARDSON. February 1st. (Complete.)

2,411. "Improved ignition for internal combustion engines." S. GRIFFIN. February 2nd.

2,420. "Improvements in or relating to electric distributing systems." W. DICKINSON and H. LINZELL. February 2nd.

2,445. "Improved aerial machine or carriage or motor driven by electricity or other motive power." A. TIMLINS and H. LAMARCHAND. February 2nd.

2,461. "Improvements in and relating to electric motor starting switches." SIEMENS BROS. DYNAMO WORKS, LTD., and E. SCHUPP. February 2nd.

2,492. "Improvements in electrical cranes, winches, hoists and the like." E. OAKDEN. February 2nd.

2,520. "Regulating system for alternate current installations." A. HEYLAND. (Date applied for under Sec. 91 of the Act, February 3rd, 1908, being date of application in Germany.) February 2nd. (Complete.)

2,526. "Apparatus for discharging accumulators or primary batteries into an alternating-current circuit and for charging accumulators by an alternating current." F. S. HEYS. February 2nd. (Complete.)

2,528. "Improvements in type-writing telegraphs." E. W. BRECH. February 2nd.

2,529. "Improvements in electric protective devices of the type suitable for use as lightning arresters." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 2nd.

2,550. "Switch for closing and opening an electric circuit." O. BAKER. February 3rd.

2,552. "Improvements in or relating to electric arc lamps of the flame arc type." C. W. HILL and T. C. E. ROWLAND. February 3rd.

2,553. "Improvements in and connected with electric arc lamps of the flame arc type." C. W. HILL and T. C. E. ROWLAND. February 3rd.

2,554. "Improvements in audible electric signalling devices and the like." T. S. ROGERS. February 3rd.

2,578. "Improvements in electrical switches." J. H. TUCKER. February 3rd.

2,585. "Improvements relating to electric tramcars." J. W. DUGDALE. February 3rd.

2,605. "Improvements in and relating to electric time switches." W. E. RICHTER. February 3rd. (Complete.)

2,611. "Improvements in joints for electrical conductors." BRITISH ALUMINIUM CO., LTD., and F. HORN. February 3rd.

2,612. "Improved damp-proof box for electric switches and wall plugs." W. N. HADEN and C. I. HADEN (trading as G. N. Haden & Sons), and C. A. BLACKMAN. February 3rd.

2,632. "Roller-fitted massage apparatus with an arrangement for conveying induction current into the part of the body to be massaged." M. LIPKE (*nee* Czachowska). February 3rd.

2,634. "Electrically-operated gun control." J. B. RYAN. (Date applied for under Sec. 91 of the Act, February 3rd, 1908, being date of application in United States.) February 3rd. (Complete.)

2,641. "Improvements in treating wood to render it suitable for use in secondary or storage batteries." P. MARINO. February 3rd. (Complete.)

2,642. "Improvements in and relating to machines for electrically-welding chains." AKT-GES. STAHLWERKE WEISSENFELS VORMALS GOPPINGER & CO. (Date applied for under Sec. 91 of the Act, February 3rd, 1908, being date of application in Germany.) February 3rd. (Complete.)

2,667. "Improvements in the construction of trolley-heads for electric trams and the like." A. BREVERS, R. CARNEGIE and A. CROWCROFT. February 4th.

2,674. "Improved ignition method for internal combustion engines." J. SOUTHALL. February 4th.

2,682. "Improvements in and relating to secondary or storage batteries." P. MARINO. February 4th. (Complete.)

2,686. "Improvements in dynamo-electric machines for train lighting and like purposes." SIEMENS BROS. DYNAMO WORKS, LTD., M. KLOSS and T. F. WALL. February 4th.

2,687. "Improvements in shades for electric light or other illuminant." J. YOUNG. February 4th.

2,715. "Improvements in controllers for electric motors." R. F. BAERLOCHER. February 4th.

2,720. "Improvements in clips or clamps applicable as tools for removing electric lamp shade rings, nuts, plugs, and the like." D. L. J. BROADBENT. February 4th.

2,733. "Improvements in circuit interrupters to take the place of a fuse in electric lighting and power installations." J. E. SPAGNOLETTI. February 4th.

2,740. "Improvements in electrically-operated valves." E. A. FAGERLUND. (Date applied for under Sec. 91 of the Act, February 5th, 1908, being date of application in Sweden.) February 4th. (Complete.)

2,749. "Improvements in the manufacture and arrangement of the electrodes of secondary batteries (accumulators)." H. GARDE and A. J. ADAMS. (Date applied for under Sec. 91 of the Act, April 2nd, 1908, being date of application in France.) February 4th. (Complete.)

2,754. "Improvements in or relating to switches for electrical purposes." T. J. ROBKE and E. ROBKE. February 4th. (Complete.)

2,767. "Improvements in or relating to electrical thermometers and pyrometers." W. S. PEAKE. February 5th.

2,770. "Improved lifeguard for horse tramways, electric tramways or like railways." J. CORBILL and R. H. MCCOMBE. February 5th.

2,779. "Improvements in the control systems of theatrical and like electric lights." E. M. M. JOHNSTONE. February 5th.

2,843. "Improvements in processes of plating metals." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 6th. (Complete.)

2,844. "Improvements in metal plating." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 5th. (Complete.)

2,851. "Improvements in telephone exchanges." SIEMENS BROS. CO., LTD. (Siemens & Halske A.-G., Germany.) February 5th. (Complete.)

2,853. "Improved manufacture of electrical incandescence filaments from tungsten or other difficultly ductile metals." SIEMENS & HALSKE AKT.-GES. (Date applied for under Sec. 91 of the Act, February 11th, 1908, being date of application in Germany. Application for Patent of Addition to No. 4,814, 1908.) February 5th. (Complete.)

2,900. "New or improved method of governing the speed of marine engines and turbines electrolytically and electrically." A. MARTIN and H. JACKSON. February 6th.

2,933. "Improvements in or relating to electric traction systems." B. D. FOX and RAILLESS ELECTRIC TRACTION CO., LTD. February 6th.

2,939. "Improvements in mechanism for hydraulically controlling parts like valves, ignition devices or detents." BACHRECH & Co. (Application for Patent of Addition to No. 23,351 of 1908. Date applied for under Sec. 91 of the Act, February 8th, 1908, being date of application in Germany.) February 6th. (Complete.)

2,943. "Improvements in and relating to electrical controllers." J. G. THOMAS. February 6th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

ELECTRO-CHEMICAL PROCESS FOR THE MANUFACTURE OF ACETATES, AND IN PARTICULAR, ACETATE OF SODA. C. H. Jacobs. 726. January 11th.

ELECTRIC SWITCHES. J. A. Kennedy-McGregor and H. H. Mountford. 2,175. January 31st.

CONTROLLING MECHANISM FOR ELECTRICALLY-OPERATED BASCULE BRIDGES. W. Dixon. 4,307. February 20th.

LIQUID MAGNETIC COMPASSES. C. Batty and W. Batty. 4,883. March 4th.

METALLIC FILAMENTS OR RODS FOR ELECTRIC INCANDESCENT LAMPS. F. J. Planchon. 5,040. March 5th. (Date applied for under International Convention, November 9th, 1907.)

ELECTRIC LAMPS FOR MOTOR CYCLES AND THE LIKE. J. W. Greenwood. 5,078. March 6th.

ELECTRIC ARC LAMPS. A. D. Jones. 5,829. March 16th.

REFINING OF STEEL IN ELECTRIC FURNACES. Bismarckhutte Co. 6,029. March 18th. (Date applied for under International Convention, September 16th, 1907.)

MAGNETO-ELECTRIC IGNITION APPARATUS. A. Zähringer. 7,014. March 30th.

ELECTRIC TRACTION AND LIKE SYSTEMS. British Thomson-Houston Co. (General Electric Co., United States.) 7,424. April 3rd.

ELECTRICAL FURNACES. J. Bouneau. 8,904. April 28rd. (Date applied for under International Convention, April 24th, 1907.)

ELECTRICAL TRANSMISSION OF HALF-TONE OR LIKE PHOTOGRAPHS. T. T. Baker. 9,518. May 2nd.

VARIABLE-SPEED GEAR FOR ELECTRIC AUTOMOBILES. C. M. de Sainte Claire. 9,877. May 6th. (Date applied for under International Convention, November 11th, 1907.) (Application for Patent of Addition to No. 9,876/08.)

ELECTROLYTIC METERS. G. Hookham and A. H. Holden. 10,614. May 15th. (Application for Patent of Addition to No. 3,827/05.)

ELECTRICALLY-PROPELLED VEHICLES. H. Thayer. 10,687. May 16th.

ANTI-VIBRATING LEAD TERMINAL FOR ELECTRICAL IGNITION MOTORS OR THE LIKE. J. Wood and W. Wood. 10,820. May 19th.

INCANDESCENT ELECTRIC LAMPS. British Thomson-Houston Co. and T. E. Robertson. 11,410. May 26th.

TROLLEYS OR COLLECTORS FOR ELECTRIC TRAMCARS. J. Curran and E. Kelly. 13,299. June 23rd.

ELECTRIC FUSE BOXES. R. Grose and W. R. Lambert. 13,515. June 25th. (Application for Patent of Addition to No. 6,849/07.)

DRIVING OR GOVERNING THE INDUCTOR OF TELEPHONE APPARATUS. C. Büschelberger. 15,370. July 20th. (Date applied for under International Convention, July 18th, 1907.)

SPRING SWITCHES FOR ELECTRICALLY SETTING RAILWAY POINTS AND SIGNALS. Siemens & Halske Akt.-Ges. 16,164. July 30th. (Date applied for under International Convention, September 2nd, 1907.)

APPARATUS FOR WASHING DETINNED MATERIAL OR THE LIKE AFTER OR BEFORE ELECTROLYSIS. London Election Works Co. and E. Kardos. 17,113. August 14th.

REVERSIBLE GALVANIC BATTERIES. C. H. Hubbell and H. W. Fuller. 17,331. August 18th.

CONTINUOUS-CURRENT MOTORS. D. Dupont and Harle et Cie. 17,852. August 25th. (Date applied for under International Convention, August 27th, 1907.)

REGENERATIVE SYSTEM OF CONTROL FOR ELECTRIC MOTORS. W. Cooper. 18,275. August 31st. (Date applied for under International Convention, September 3rd, 1907.)

OIL SWITCHES FOR ELECTRIC CURRENTS. J. B. Opsahl. 19,871. September 22nd.

ELECTRICAL POTENTIAL REGULATORS OR SPEED CONTROLLING DEVICES. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 19,890. September 22nd. (Application for Patent of Addition to No. 14,725/07.)

SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. J. H. Hall. 20,091. September 24th.

ROTARY CURRENT BREAKERS FOR MAGNETO-ELECTRIC IGNITION APPARATUS. Ruthardt & Co. 21,195. October 7th.

DEVICE FOR DRIVING ELECTRIC SECONDARY CLOCKS. W. Fairweather. (Aktiebolaget L.M. Ericsson & Co.) 22,713. October 26th.

DETECTION OF FAULTS IN OVERHEAD LINES FOR HIGH-TENSION ALTERNATING ELECTRIC CURRENTS. Siemens Bros. Dynamo Works, Ltd., and F. Lydall. 23,040. November 2nd.

Mercury Vapour Carbon-Filament Lamp.—The device adopted by Mr. Bastian, of burning a glow lamp in parallel with his mercury vapour lamp so as to furnish the red rays missing from the latter, is known to our readers; a Mr. R. Hopfelt has invented a somewhat similar combination, in which the carbon filament is actually inside the U-shaped mercury vapour tube. The carbon at first lights up alone, but the small quantity of mercury in the tube becomes heated, and at the end of about five minutes it is vaporised, when the result is an increase in illumination with an efficiency of 1·5 to 1·6 watts per C P.